THE INSTITUTE OF PAPER CHEMISTRY

Appleton, Wisconsin

AN EVALUATION OF THE SAMPLING EFFICIENCIES OF TWO TYPES OF ARTIFICIAL SUBSTRATE SAMPLERS

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AN EVALUATION OF THE SAMPLING EFFICIENCIES OF TWO TYPES OF ARTIFICIAL SUBSTRATE SAMPLERS

SUMMARY

During the months of May through September 1974 an extensive comparison was made of two artificial substrate samplers, currently in use by the Aquatic Biology Group at The Institute of Paper Chemistry, with all available natural substrate samplers for three stream habitat types. The stream habitats included a large moderate velocity, sand bottom stream (Wolf River near Shiocton, Wisconsin) a shallow rock riffle on a smaller wadeable stream, and a slow run or pool area on the same smaller stream (Tomorrow River near Amherst, Wisconsin). All habitat areas were in areas free from major waste sources.

Artificial substrates were compared with natural substrates in each area. Samples were taken at approximately 6 week intervals throughout the summer months and into September. Comparisons were made to determine the relative efficiency of each sampler type in the three habitats. Data analysis was performed to determine whether artificial substrate populations closely resemble populations in the sample area or include individuals more representative of upstream habitats.

Calculations were also made for a numerical diversity index, an evaluation of taxonomic composition, change in sampler efficiencies with seasonal changes, and a cross comparison by cluster analysis of coefficients of similarity.

A vast quantity of data was accumulated during this study and it was found that the artificial substrates supported populations similar to that present in the sample area and that these techniques were generally as efficient at sampling natural communities in terms of number of taxa as were natural substrate samplers.

However, the comparisons of similarity coefficients, taxonomic composition and individual samplers indicates that while artificial substrates will provide adequate information in shallow stream pools and riffles, they are not superior to the collection of multiple samples of natural substrates. In cases where quantitative data for lotic populations is available from natural substrates these are to be preferred.

In the larger, deeper stream habitat the opposite situation was found. The best samplers in terms of representative quantitative data were the artificial substrates. These were the only quantitative samples of lotic communities available for this habitat and the artificial substrates also provided a generally better sampling of community diversity.

The conclusion of this study is that the use of artificial substrate samplers (with the ball basket preferred) is a valid technique for obtaining samples which are representative of local resident populations. Multiple sampling of natural substrates should be utilized where possible but in cases where lack of quantitative data, unsuitable substrates, or related cost factors dictate, the artificial substrates remain as valid sampling tools.

INTRODUCTION

The use of macroinvertebrate communities to evaluate changes in water quality is widespread among governmental agencies, research and educational organizations, and consulting agencies working for private industry. It is probably also true that all of these same data collecting organizations have one or more studies which rely upon artificial substrate (AS) programs to sample resident benthic communities. In some cases the artifical substrate technique is used exclusively and in preference to accessible natural substrates.

A wide variety of artificial substrate materials have been employed to collect macroinvertebrates including polyethylene (1), shallow trays of rock (2), conservation webbing (3), concrete blocks, balls, or cones (3, 4). In spite of the variety of substrates tested, two general types have been widely accepted by the majority of current investigators. These include the basket sampler originally suggested by Mason and Anderson (5, 6) and the Hester-Dendy wood (masonite) plate sampler (7). The basket sampler was originally filled with a limestone substrate but IPC biologists have accepted the recent introduction of unglazed porcelain balls (8).

Numerous comparisons between one or more artificial substrate types with conventional sampling techniques have appeared in the literature, usually having a limited application (9). These studies have compared density and/or diversity of communities sampled by a few (usually two) standard techniques under limited location conditions. Questions regarding the artifical substrate technique still exist as to the source of organisms which colonize the samplers, how efficient are the samplers at measuring density and diversity of forms resident to the sample area as opposed to those which colonize the samplers from the drift, and what habitat types are most conducive to sampling by artifical substrates.

The Aquatic Biology Group has employed artifical substrate samplers under a variety of conditions for the last five years. However, the limits of the technique have restricted the usefulness of information available from artificial substrate studies. The present project attempts to answer several questions regarding artificial substrate samplers:

1. How efficient are artificial substrates at measuring macro-invertebrates resident to the sample station area and how does this compare with other available sampling techniques?

2. What habitat areas are vulnerable to sampling by artificial substrates and how efficient are the AS samplers as compared to other available sampling techniques?

3. How do wood substrates compare to porcelain ball substrates?

4. Are there seasonal changes in sampler efficiencies for different habitats?

MATERIALS AND METHODS

STUDY AREA

The study areas were selected to provide a cross section of habitat types which could be sampled both by artificial substrates as well as a variety of other accepted sampling techniques for comparison. Two nearby streams were chosen which represented the desired habitat types; the Wolf River and the Tomorrow River.

The Wolf River in the vicinity of Shiocton, Wisconsin is a mature, moderately eutrophic warm water (15-22°C) stream. This river is characterized by moderate current velocities (30 cm/sec) in the sample area with a relatively straight deep (6-21 ft) run for the remainder of its length to its junction with Lake Poygan in Winnebago County. No known point waste sources were present in the vicinity of the study site and the river was considered to support a "normal" unaltered water quality throughout the study period.

The Wolf River sample station was located at the site of a wood and steel rail trestle approximately two miles downstream from the town of Shiocton, WI. The bridge provided a convenient attachment site for the two sets of artificial substrates as well as being conveniently accessible.

Two locations were used on the Tomorrow River in Portage County approximately 3 river miles south of the town of Amherst, Wisconsin. The Tomorrow River in this part of its course is a cold water trout stream which is quite productive of fish and invertebrate biomass. No point source wastes affect the stream in the study area, however, agricultural uses of river water for irrigation contribute to the fertility and productivity of the stream.

Two sets of samplers were utilized at two sites on the Tomorrow River. The first location was a shallow (12-20 inches) rocky riffle area with a temperature range of 16°C (May 20 and September 5) to 22°C (June 28) and an average temperature of 18°C. Current velocities remained at 60-70 cm/sec, pH was around 8.5 and dissolved oxygen levels were consistently near saturation. Artificial substrate samplers were attached to tree roots on shore and laid on the rocky bottom in 16-20 inches of water in good current. A second set of samplers was deployed in slightly slower current (40-50 cm/sec) at the downstream end of the riffle. This was an attempt to obtain a second riffle sample which may have supported a slightly different fauna than the surrounding natural substrates. It was intended to check on whether the artifical substrate samplers would support a population similar to the immediate riffle area or to the upstream riffle area.

The second Tommorrow River location was situated in a slow run habitat which was the closest thing to a still water pool for this section of the river. This location was approximately 200-yards upstream from the riffle area and was characterized by a current velocity of 20-30 cm/sec in the fastest flow areas, a depth of 14-18 inches and a temperature, pH and dissolved oxygen composition which was the same as at the downstream riffle habitat.

The artificial substrate samplers used were the two most commonly employed types both by the Aquatic Biology Group as well as other researchers. One was the modified chicken bar-b-que basket as described by Mason and Anderson (5, 6) and the other was the masonite plate sampler prepared by Hester and Dendy (7) with modifications according to Fullner (10). The plate sampler was fastened to the attachment cable holding the basket sampler. The basket thus provided weight and stability for the plate sampler and kept locations of the two samplers in each set relatively uniform and comparable. The basket sampler was filled with

30, 2-inch unglazed porcelain balls. This substrate material has been tested and found to be comparable to limestone rock as an artificial substrate (Zanella, unpublished) [Mason et al. (8)]. The uniform size of the porcelain balls allows for reproducibility of sample size between station locations.

In addition to artificial substrates all accessible natural substrates in the habitat area were sampled with one or more of several standard sampling techniques. This multiple sampling accomplished two objectives. The first was to delineate the nearly complete taxonomic composition of all macrobenthic invertebrates in the habitat area. The second was to compare the relative efficiency of each sampling technique's ability to measure the entire cross section of resident macroinvertebrates.

The natural substrate sampling techniques included the Surber square foot sampler; qualitative rock samples; qualitative wood samples; Ekman dredge samples; qualitative net samples from shoreline and bottom vegetation; and Petersen dredge samples. Quantitative samples were obtained whenever possible.

The Surber square foot sampler was used in shallow rock riffle habitats. For a description of all apparatus used see EPA Biological Methods manual (11). Rock substrates were lifted carefully from the open square of the Surber net and placed into a basket. Organisms washing into the net were added to the bucket. All organisms were scraped and brushed off the collected rock substrates, and subsequently sieved in a standard U.S. 30-mesh screen to remove silt and water. Samples were preserved in approximately 10% formaldehyde and returned to the laboratory for analysis. This technique was accepted as providing quantitative samples and was limited primarily to the Tommorrow River riffle station.

The Ekman dredge [see (11)] was used in soft bottom silt and sand substrates to obtain largely quantitative data. This apparatus was used in the silt areas of the Tomorrow River Pool station. The silt substrate materials were sieved through a 30-mesh sieve box with the residue preserved in formaldehyde and returned to the laboratory.

The Petersen dredge is a heavier dredge apparatus than the Ekman and was used to obtain hard bottom sand and gravel samples from the deeper areas of the Wolf River station. It was also used to obtain qualitative rock samples from the same area by retrieving large rocks in single fashion from the river bottom. Qualitative rock and wood substrates were obtained by picking up rocks and wood debris, branches and old bridge pilings from suitable habitat areas until a workable sample was obtained or until all available substrates had been investigated. The life forms were then removed, screened and preserved as previously described.

Qualitative net samples were obtained by dragging a Turtox pond net (20 micron mesh) 3 or 4 times through vegetation growing in the study areas. The captured organisms were then deposited into a basket, screened and preserved. At the Wolf River sample station, the net was dragged through the leaves and branches of tree limbs which hung in the water. This was only done in June as dropping water levels in later months left the tree limbs out of water.

Preserved samples were sorted in the laboratory, counted and identified to the lowest accurate taxonomic level possible using a series of standard taxonomic references (12-28). Data analysis included cluster analysis according to the computer program of Pinkham (29) as modified by John Church (personal communication) and an IBM 360 computer. Diversity index calculations for $\bar{D}$ were made according to the Shannon-Weaver applications of information theory derivations (30). The calculation of $\bar{D}$ was made according to generally accepted procedures (11, 31-35) and was performed on The Institute of Paper Chemistry's IBM 360 computer.

OBSERVATIONS AND DISCUSSION

The three areas which were chosen as sample sites supported a quite diversified fauna which included representatives of all the major benthic macroinvertebrate orders. The diversity and density of the resident communities were large enough so that a considerable amount of data was available upon which to judge the performance of the various sampling techniques. All taxa sampled by all sampling techniques throughout the four month period were combined to represent the total resident macroinvertebrate population at each study site. The efficiency of each individual sampling technique is represented as the percent of the total population that technique sampled.

A complete list of all taxa and number of individuals sampled at each site for each month by each technique is presented in Appendix I. A partial summary of data is also included in this appendix.

RELATIVE EFFICIENCIES

Table I presents the diversity of sampled populations at each station on a monthly basis by sampling technique for each study site. It can be seen that 92 different taxa were sampled at Station 1, the Tomorrow River Pool site. Of these the highest found in any single month was 63 taxa in the May harvest period. This represents 68 percent of the total sampled population.

The most reliable sampling techniques for this habitat, including the Surber, qualitative wood, and artificial substrate samplers, produced rather consistent results from one sampling period to the next. These samplers did not vary greatly in number of taxa sampled for each harvest date. The Ekman dredge samples, however, fluctuated somewhat due to localized changes in soft sediment composition with sandy bottom types supporting smaller populations than

TABLE I

TAXA SAMPLED BY SAMPLER TYPE FOR EACH PERIOD

Sample Type	May					June					July					September					Total	
	No. Taxa	Total Taxa, %	Monthly Taxa, %	Av. No. Individuals per Sampler	No. Samples	No. Taxa	Total Taxa, %	Monthly Taxa, %	Av. No. Individuals per Sampler	No. Samples	No. Taxa	Total Taxa, %	Monthly Taxa, %	Av. No. Individuals per Sampler	No. Samples	No. Taxa	Total Taxa, %	Monthly Taxa, %	Av. No. Individuals per Sampler	No. Samples	Total Different Taxa	Total Taxa, %
Station 1. Tomorrow Pool																						
Surber	49	53	77	1339	(2)	33	35	61	198	(2)	32	34	56	127	(2)	32	34	58	195	(2)	65	71
Qual. wood	34	36	53	947	(1)	25	27	46	423	(1)	25	27	43	268	(1)	25	27	45	307	(1)	50	54
Ekman	13	14	20	18	(4)	13	14	24	299	(3)	12	13	21	18	(3)	8	8	14	61	(3)	27	29
Balls	--	--	--	--	--	34	36	62	237	(2)	36	39	63	461	(2)	33	35	60	813	(2)	59	64
Plate	--	--	--	--	--	22	20	40	82	(2)	24	26	42	86	(2)	24	26	43	211	(2)	38	41
Total monthly combined samples	63	68	100	--	(7)	54	72	100	--	(10)	57	--	100	--	(10)	55	59	100	--	(10)	92	100
No. of taxa found only on balls — 1																						
No. of taxa found only on plates — 1																						
Station 2. Tomorrow Riffle																						
Surber	60	89	67	1804	(4)	46	90	51	1230	(4)	40	48	83	551	(4)	43	48	82	685	(4)	78	87
Qual. wood	45	67	50	2498	(1)	32	62	35	1646	(1)	29	32	60	743	(1)	35	39	67	1070	(1)	55	61
Qual. rock	38	56	42	8560	(1)	--	--	--	--	--	--	--	--	--		--	--	--	--		38	42
Balls	--	--	--	--		36	70	40	3070	(2)	30	33	62	857	(2)	30	33	57	1114	(2)	44	49
Plates	--	--	--	--		34	66	38	1257	(2)	26	29	54	213	(2)	25	28	48	382	(2)	40	44
Qual. net	--	--	--	--		--	--	--	--		15	25	31	307	(1)	13	14	25	622	(1)	23	25
Total monthly combined samples including AS	67	75	100	--	(6)	51	57	100	--	(9)	48	53	100	--	(10)	52	58	100	--	(10)	89	100
No. of taxa found only on balls — 0																						
No. of taxa found only on plates — 1																						
Station 3. Wolf River																						
Qual. wood	34	29	61	1239	(2)	33	28	44	3520	(1)	23	19	42	1810	(1)	32	27	62	5903	(2)	51	43
Qual. rock	22	18	32	203	(1)	32	27	43	286	(1)	35	29	64	1602	(1)	35	29	68	2406	(2)	55	47
Petersen	14	11	25	65	(3)	20	17	27	184	(4)	13	10	24	52	(2)	8	6	15	32	(2)	35	29
Net qual.-veg.	8	6	10	101	(1)	15	12	20	760	(1)	--	--	--	--		--	--	--	--		20	17
Net qual.-trees	--	--	--	--		17	14	22	185	(1)	--	--	--	--		--	--	--	--		17	14
Balls	--	--	--	--		41	35	55	2412	(2)	32	27	59	3086	(2)	35	29	68	5641	(2)	52	44
Plate	--	--	--	--		36	30	48	1227	(2)	29	24	53	1888	(2)	26	22	50	3118	(2)	45	38
Total monthly combined samples including AS	55	47	100	--	(7)	74	63	100	--	(12)	54	46	100	--	(8)	51	43	100	--		117	100
No. of taxa found only on balls — 3																						
No. of taxa found only on plates — 3																						

silt. For the period June through September, the Surber averaged 32 taxa as compared to 34 taxa for the ball basket. It can also be seen that a comparison of the total different taxa sampled throughout the study period, excluding May, for combined harvest dates shows that 43 different taxa (57% of total taxa for June-September) were sampled by Surber samplers while 50 taxa (66% of total taxa for June-September) were collected by the ball basket. The plate sampler picked up 38 taxa (50% of total taxa for June-September).

In Table II total taxa for combined samples are presented as well as average density information for each sampler type. In terms of population density the ball basket densities were very close to those measured by Surber sampler. Plate sampler densities were considerably lower and were equivalent to only 25% of the population sampled by the ball basket.

At Station 2, the Tomorrow River riffle habitat, similar comparisons between natural and artifical substrates were observed. A total taxonomic composition of 89 different macroinvertebrates was sampled during the study period. Of these 78 taxa were sampled by Surber sampler while 44 were sampled by ball baskets and 40 by plate samplers. However on a monthly basis the comparisons between natural rock populations and porcelain ball populations was closer. For harvests between June and September the Surber samples averaged 44 taxa and the ball basket samplers averaged 32 taxa. Qualitative wood samples averaged 32 taxa and plate samplers averaged 28 taxa excluding May. Surber samples excluding May contained a total of 46 taxa. (The exclusion of May data in totals allows comparisons for those months in which artificial substrates were collected.)

TABLE II

TOTAL TAXA, TOTAL INDIVIDUALS AND SAMPLER EFFICIENCY AS PERCENT FOR EACH HABITAT

	Total Taxa	Taxa on Sampler	Sample, % Total Taxa	Av. No. Individuals per Sampler
Tomorrow Riffle	89 (70)[a]			
Surber		78 (46)	87 (65)	1067
Qual. wood		55 (45)	61 (64)	1489
Qual. rock		38	42 (54)	8560
Combined balls		44	49 (62)	1680
Plate		40	44 (57)	617
Qual. net		23	25 (32)	456
Tomorrow Pool	92 (75)			
Surber		65 (43)	71 (57)	464
Qual. wood		50 (36)	53 (54)	648
Ekman		27	29 (36)	100
Balls		50	43 (66)	503
Plates		38	41 (50)	1126
Wolf River	117 (95)			
Qual. wood		51 (41)	43 (43)	3269
Qual. rock		55 (51)	47 (53)	13,806
Petersen		35	29 (36)	64
Net grass		20	17 (21)	430
Net trees		17	14 (17)	185
Balls		52	44 (54)	3713
Plates		45	38 (47)	2094

[a] Totals in parentheses are refigured to exclude samples taken in May for which period there are no corresponding artificial substrate samples.

The seeming discrepancy between the Surber total diversity of 78 and the monthly average of 44 was due to the influence of May samples. As is apparent in Table I, a much higher population was present on the riffle habitat in May than was sampled throughout the remaining summer months. Excluding the taxa found only in May, a total population diversity of 70 taxa was observed and a Surber total of 46 taxa was collected. This figure is 65% of the total adjusted population. The ball basket total of 44 taxa or 62% of the adjusted total is

almost identical to that of the Surber. Over the multiple sampling period the basket sampler was essentially as efficient as the Surber sampler, exceeded the qualitative rock samples and was similar to the qualitative wood samples which supported the same number of taxa as the Surber sampler.

It was evident however that the relative efficiency of any component sample did not exceed 65% of the diversity resulting from combined sampling. This level was consistent for the major sampling techniques under investigation as well as between both the pool and riffle habitat areas on the Tomorrow River.

The density of colonization on the artificial versus natural substrates in the Station 2 riffle habitat was similar to the relationship for the pool habitat. Among the quantitative samples the ball basket supported the largest numbers with an average of 1600 individuals per sampler*. The Surber sampler averaged 1067 while the plate sampler supported 617 individuals per sampler (or 440 per square foot). The plate sampler supported far fewer individuals but only slightly fewer taxa. Comparisons with natural wood substrates were not possible due to the lack of a quantitative measure of these substrates.

Similar efficiencies were obtained for samples taken from the third habitat, Station 3, a large stream portion of the Wolf River. A total population including 117 taxa were found at this habitat which exceeded even the productive stream riffle habitat on the Tomorrow River. No individual sample technique captured more than half this total number of taxa with a 47% sampling by qualitative rock substrates coming the closest.

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[a] Ball basket sampler surface area is unknown, includes wire basket as well as procelain balls. Plate sampler is equal to 1.4 square feet.

When May samples are excluded from the total population a diversity of 95 taxa remains for the sampling period in which artificial substrates were obtained. It can be seen from Table II that the ball basket samplers were the most efficient single sampler in terms of taxa sampled. This artificial substrate sampled 52 taxa for an efficiency of 54% of the total adjusted sampled population. The natural rock substrate, sampled qualitatively, obtained 51 taxa for 53%. The plate sampler exceeded the qualitative wood samples with 53 taxa for 47% of the population. One reason for the suggested advantage of artificial sustrate samplers over natural substrates is that the ball baskets and plates can be deployed in areas with most advantageous habitat conditions or in specific areas where a sample is desired and can be harvested very easily. The natural substrates, on the other hand, may not always occur in the best habitat conditions and are more difficult to adequately sample.

TAXONOMIC COMPOSITION

The sampled populations in all three habitat areas were evaluated in terms of their taxonomic composition. This was done to evaluate for selectivity among the sampler types. Some selectivity in terms of macroinvertebrate habitat preference could be expected but severe selectivity would affect the applied value of data collected by either artificial substrate technique.

Table III presents number of taxa found in each taxonomic group by sampler and by month for each habitat area. In the Wolf River, a large stream habitat, the ball samplers tended to collect one or two more taxa of Coleopterans than did the natural rock substrates and tended to collect one or two fewer Dipteran taxa. In other groups there was no apparent consistent difference in sampling of taxonomic groups. Plate samplers showed no consistent differences in any taxonomic category.

TABLE III

DISTRIBUTION BY ORDER OF TAXA SAMPLED IN THE WOLF AND TOMORROW RIVER HABITATS
GIVEN AS NUMBER OF TAXA

Part 1. Tomorrow River Pool

Month & Sampler	Plecoptera	Ephemeroptera	Trichoptera	Turbellaria	Amphipoda	Coleoptera	Isopoda	Decapoda	Odonata	Hemiptera	Diptera	Gastropoda	Oligochaeta	Hirudinea
May														
Surber	2	11	12	1	1	3	0	1	0	0	12	2	3	1
Qual. wood	1	10	8	0	1	2	0	0	1	0	9	0	2	0
Ekman	0	2	0	0	0	0	0	0	0	0	8	0	3	0
Ball	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Plate	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total different	2	14	14	1	1	4	0	1	1	0	18	2	4	1
June														
Surber	1	8	7	0	1	1	1	1	1	0	10	1	1	0
Qual. wood	2	5	6	1	1	1	1	0	0	0	7	0	1	0
Ekman	1	2	0	0	0	0	0	0	0	0	7	0	3	0
Ball	1	9	7	0	1	0	1	2	0	1	8	1	2	0
Plate	0	6	2	0	1	0	1	1	0	2	6	1	2	0
Total different	2	12	8	1	1	1	1	2	1	2	17	1	4	0
July														
Surber	0	7	6	1	1	4	0	0	0	0	8	1	4	0
Qual. wood	2	7	3	1	1	2	0	0	0	0	7	1	1	0
Ekman	0	1	1	0	0	0	0	0	0	0	7	0	3	1
Ball	0	8	6	1	1	1	1	2	0	1	12	1	2	0
Plate	1	7	5	0	1	1	0	2	0	0	6	1	2	0
Total different	2	10	8	1	1	5	1	3	0	1	19	1	4	1
September														
Surber	0	8	6	1	1	3	1	1	0	0	8	1	1	0
Qual. wood	2	8	5	0	1	1	0	0	0	0	7	0	1	0
Ekman	0	1	0	0	0	0	0	0	0	0	4	0	2	1
Ball	2	9	6	0	1	1	0	3	0	0	8	1	2	0
Plate	2	9	4	0	1	0	0	0	0	0	8	0	2	0
Total different	2	12	10	1	1	4	1	3	0	0	15	1	5	1
All months combined	3	17	14	1	1	6	1	3	2	2	30	2	7	3

TABLE III (Continued)

DISTRIBUTION BY ORDER OF TAXA SAMPLED IN THE WOLF AND TOMORROW RIVER HABITATS
GIVEN AS NUMBER OF TAXA

Part 2. Tomorrow River Riffle

Month & Sampler	Plecoptera	Ephemeroptera	Trichoptera	Turbellaria	Amphipoda	Coleoptera	Isopoda	Decapoda	Diptera	Gastropoda	Pelecypoda	Oligochaeta
May												
Surber	4	15	13	1	1	4	1	1	17	1	1	5
Qual. wood	4	9	10	1	1	4	1	0	11	1	0	3
Qual. rock	4	11	10	0	1	1	0	0	10	0	0	1
Qual. net	--	--	--	--	--	--	--	--	--	--	--	--
Balls	--	--	--	--	--	--	--	--	--	--	--	--
Plate	--	--	--	--	--	--	--	--	--	--	--	--
Total different	4	16	14	1	1	6	1	1	18	1	1	5
June												
Surber	4	14	11	1	1	3	1	1	11	0	0	2
Qual. wood	3	9	8	0	1	1	1	0	8	0	0	1
Qual. net	0	6	3	0	1	0	0	0	5	0	0	0
Balls	3	11	9	1	1	2	1	1	8	0	0	2
Plate	4	9	7	0	1	1	1	0	10	0	0	2
Total different	5	13	12	1	1	3	1	1	13	0	0	3
July												
Surber	1	10	10	1	1	2	1	1	15	0	0	1
Qual. wood	2	4	8	0	1	2	1	0	11	0	0	0
Qual. net	0	5	2	1	1	0	1	0	5	0	0	0
Balls	2	10	6	0	1	2	1	2	6	0	0	1
Plate	1	7	8	1	1	1	1	1	8	0	0	0
Total different	2	11	12	1	1	3	1	2	15	0	0	1
September												
Surber	1	9	12	1	1	4	1	2	13	1	0	1
Qual. wood	2	9	8	1	1	2	0	1	9	1	0	1
Qual. net	0	4	2	0	1	0	0	0	6	0	0	0
Balls	2	6	6	0	1	2	1	1	9	1	0	1
Plate	1	7	6	0	1	1	0	2	7	0	0	0
Total different	2	10	14	1	1	4	1	2	15	1	0	1
All months combined	5	18	19	1	1	8	1	3	24	1	1	7

TABLE III (Continued)

DISTRIBUTION BY ORDER OF TAXA SAMPLED IN THE WOLF AND TOMORROW RIVER HABITATS
GIVEN AS NUMBER OF TAXA

Part 3. Wolf River

Month & Sampler	Plecoptera	Ephemeroptera	Trichoptera	Coleoptera	Turbellaria	Isopoda	Amphipoda	Hydracarina	Odonata	Hemiptera	Neuroptera	Diptera	Gastropoda	Pelecypoda	Oligochaeta	Hirudinea
May																
Qual. rock	0	0	3	1	0	1	1	0	0	0	0	10	1	1	4	0
Qual. wood	1	4	11	4	0	1	1	0	0	0	0	11	0	0	2	0
Petersen	1	0	0	1	1	1	0	0	0	0	0	3	0	1	3	1
Balls	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Plate	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Net	1	2	0	0	0	0	1	0	0	0	0	2	0	1	1	0
Total different	1	6	12	4	1	1	1	0	0	0	0	18	1	2	6	1
June																
Qual. rock	0	4	8	3	1	0	1	0	0	0	1	8	3	1	2	0
Qual. wood	1	4	8	4	1	0	1	0	0	0	0	12	0	1	1	0
Petersen	0	2	0	2	1	1	1	0	0	0	0	3	0	1	3	0
Balls	2	5	11	5	1	1	1	0	0	0	0	13	0	0	3	0
Plate	1	6	12	4	0	1	1	0	0	0	0	11	0	0	1	0
Net	1	4	0	2	0	0	1	1	0	4	0	7	0	1	1	0
Total different	3	11	15	6	1	1	2	1	0	4	1	17	3	2	7	0
July																
Qual. rock	0	4	11	2	1	0	1	0	0	0	0	12	3	1	0	1
Qual. wood	0	3	6	4	1	0	1	0	0	0	0	9	0	0	0	0
Petersen	0	3	4	1	1	0	0	0	0	0	0	1	0	0	2	0
Balls	0	6	10	3	1	1	1	0	0	0	0	10	0	0	0	0
Plate	1	6	6	3	1	0	1	0	1	0	0	9	1	0	1	0
Net	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total different	1	8	13	5	1	1	2	0	1	0	0	14	3	1	3	1
September																
Qual. rock	0	5	9	1	1	1	2	0	1	0	0	12	1	1	1	0
Qual. wood	1	6	8	4	1	0	0	0	0	1	0	10	0	0	2	0
Petersen	0	0	2	1	1	0	0	0	0	0	0	2	0	1	1	0
Balls	0	6	8	5	1	0	2	0	0	0	0	11	0	0	1	0
Plate	1	5	8	3	1	0	1	0	0	0	0	7	0	0	1	0
Net	0	0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total different	1	7	11	6	1	1	2	0	1	1	0	15	1	1	3	0
All months combined	3	16	19	13	1	1	2	0	2	5	1	28	5	4	14	2

In both habitats on the Tomorrow River the plate samplers compared evenly with natural wood substrates. However in the pool area more crayfish taxa were sampled by both ball samplers and plate samplers than by natural sustrates. This was largely due to the fact that both artificial samplers allow sampling of interstital spaces preferred by crayfish while with natural substrates these spaces occur between the removed substrate and the permanent river bottom. Picking up wood or rocks from the bottom allowed crayfish to escape from natural substrates whereas they did not escape from the artificial types. Very profuse crayfish populations were observed, though not sampled, on natural substrates. The ball samplers also tended to sample one or two fewer midge taxa than did rock substrates and were consistently lower in Ephemeroptera taxa than were rock substrates in the Tomorrow pool habitat.

In Table IV a similar breakdown of taxonomic categories and sampler organization is presented for number of individuals in each taxonomic category. The lack of dependable quantitative sampling procedures hinders this comparison for some natural substrates. But even in this regard some rough comparisons are available.

In the Wolf River habitat some consistent pattern in density differences appeared only in a few taxonomic categories. The ball samplers consistently produced a larger number of Trichopterans and Dipterans than did the smaller plate sampler or the qualitative rock samples. No other categories displayed any consistent differences in numbers though minor variations did occur.

In the Tomorrow River habitats similar density patterns developed in both locations with a ball sampler preference for Ephemeropterans, Trichopterans, and Dipterans. Differences in Trichopteran numbers between samplers was not as

TABLE IV

DISTRIBUTION BY AVERAGE NUMBER OF INDIVIDUALS PER TAXONOMIC ORDER SAMPLED
IN THE WOLF AND TOMORROW RIVER HABITATS

Part 1. Tomorrow Pool

Month & Sampler	Plecoptera	Ephemeroptera	Trichoptera	Turbellaria	Amphipoda	Coleoptera	Isopoda	Decapoda	Odonata	Hemiptera	Diptera	Gastropoda	Oligochaeta	Hirudinea
May														
Surber	3	98	430	16	48	15	0	1	0	0	668	6	52	1
Qual. wood	1	143	386	0	8	8	0	0	1	0	382	0	18	0
Ekman	0	3	0	0	0	0	0	0	0	0	12	0	6	0
Ball	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Plate	--	--	--	--	--	--	--	--	--	--	--	--	--	--
June														
Surber	1	16	47	0	16	2	1	1	1	0	101	1	15	0
Qual. wood	3	298	43	0	30	1	1	0	0	0	43	0	0	0
Ekman	1	11	0	0	0	0	0	0	0	0	114	0	173	0
Ball	1	81	10	0	15	0	6	5	0	1	109	1	7	0
Plate	0	23	4	0	7	0	3	2	0	1	54	1	14	0
July														
Surber	0	26	29	4	9	6	0	0	0	0	43	5	4	0
Qual. wood	8	170	23	1	33	10	0	0	0	0	21	1	1	0
Ekman	0	1	1	0	0	0	0	0	0	0	17	0	9	1
Ball	0	93	35	1	45	1	3	4	0	0	31	5	244	0
Plate	1	59	10	0	2	1	0	2	0	1	6	2	4	0
September														
Surber	0	47	66	6	15	8	1	1	0	0	67	3	1	0
Qual. wood	13	239	30	0	7	1	0	0	0	0	16	0	0	0
Ekman	0	1	0	0	0	0	0	0	0	0	2	0	57	1
Ball	3	438	116	0	13	1	0	6	0	0	219	13	2	0
Plate	2	134	25	0	1	0	0	0	0	0	50	0	0	0

TABLE IV (Continued)

DISTRIBUTION BY AVERAGE NUMBER OF INDIVIDUALS PER TAXONOMIC ORDER SAMPLED
IN THE WOLF AND TOMORROW RIVER HABITATS

Part 2. Tomorrow Riffle

Month & Sampler	Plecoptera	Ephemeroptera	Trichoptera	Turbellaria	Amphipoda	Coleoptera	Isopoda	Decapoda	Diptera	Gastropoda	Pelecypoda	Oligochaeta
May												
Surber	2	65	560	13	12	76	1	2	772	1	1	150
Qual. wood	30	242	736	2	120	35	9	0	1185	3	0	145
Qual. rock	11	580	1045	0	1	3	0	0	6584	0	0	336
Qual. net	--	--	--	--	--	--	--	--	--	--	--	--
Balls	--	--	--	--	--	--	--	--	--	--	--	--
Plate	--	--	--	--	--	--	--	--	--	--	--	--
June												
Surber	16	189	575	10	13	39	5	2	337	0	0	231
Qual. wood	7	186	472	0	3	7	5	0	371	0	0	600
Qual. net	0	206	7	0	1	0	0	0	161	0	0	0
Balls	15	231	775	1	10	9	9	3	1981	0	0	43
Plate	20	126	514	0	6	8	6	0	570	0	0	11
July												
Surber	13	77	298	6	10	15	3	1	130	0	0	8
Qual. wood	34	58	368	0	58	12	4	0	213	0	0	0
Qual. net	0	259	5	0	14	0	0	4	24	0	0	0
Balls	11	217	394	0	5	2	1	3	219	0	0	6
Plate	8	49	89	1	1	2	1	0	63	0	0	0
September												
Surber	9	187	222	6	6	27	4	1	219	1	0	12
Qual. wood	53	336	390	4	12	34	0	1	232	2	0	6
Qual. net	0	504	3	0	8	0	0	0	107	0	0	0
Balls	9	365	276	0	1	5	4	1	446	1	0	10
Plate	8	109	42	0	1	1	0	0	98	0	0	0

TABLE IV (Continued)

DISTRIBUTION BY AVERAGE NUMBER OF INDIVIDUALS PER TAXONOMIC ORDER SAMPLED
IN THE WOLF AND TOMORROW RIVER HABITATS

Part 3. Wolf River

Month & Sampler	Plecoptera	Ephemeroptera	Trichoptera	Coleoptera	Turbellaria	Isopoda	Amphipoda	Odonata	Hemiptera	Neuroptera	Diptera	Gastropoda	Pelecypoda	Oligochaeta	Hirudinea
May															
Qual. rock	0	0	15	1	0	5	1	0	0	0	81	1	1	97	0
Qual. wood	24	70	364	17	0	2	2	0	0	0	724	0	0	18	0
Petersen	1	0	0	1	1	1	0	0	0	0	30	0	0	8	1
Balls	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Plates	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
June															
Qual. rock	0	5	61	4	2	0	7	0	0	2	142	9	3	48	0
Qual. wood	107	176	2420	57	34	0	9	0	0	0	661	0	1	26	0
Petersen	0	1	22	2	1	2	1	0	0	0	30	0	1	135	0
Balls	42	150	1338	106	13	100	103	0	0	0	528	0	0	39	0
Plates	22	64	930	12	0	3	3	0	0	0	206	0	0	4	0
July															
Qual. rock	0	556	548	48	110	0	24	0	0	0	286	26	2	0	2
Qual. wood	0	452	1144	46	44	0	2	0	0	0	122	0	0	0	0
Petersen	0	2	8	3	1	0	0	0	0	0	16	0	0	1	0
Balls	0	179	1942	13	157	3	1	0	0	0	752	0	0	0	0
Plates	2	186	1109	13	9	0	0	1	0	0	562	2	0	4	0
September															
Qual. rock	0	282	1782	6	212	2	6	2	0	0	59	30	4	5	0
Qual. wood	4	528	5004	52	158	0	0	0	1	0	184	0	0	9	0
Petersen	0	0	3	1	1	0	0	0	0	0	4	0	1	23	0
Balls	0	223	4770	53	179	0	1	0	0	0	321	4	0	6	0
Plates	1	204	2715	15	33	0	0	0	0	0	151	0	0	1	0

great in the pool area as in the riffle due to different natural population densities in the two areas. Baskets were also less obviously preferred by Dipterans in the pool station. In the riffle station numbers of Dipterans were higher on the ball baskets than for any other sample technique. Ball samplers also collected more Mayflies than did wood samples or Surber rock samples.

Trichopteran numbers were higher on the ball baskets than on any of the other samplers. Plate samplers were consistently lower in density for all the larger groups than any of the other techniques though the relative composition of the groups was similar for plate samplers as for ball and natural substrate samplers.

Decapod numbers were also higher for ball baskets than for natural substrates for reasons previously detailed. Coleoptera (beetles) was the single group of macroinvertebrates which was present in consistently greater numbers on the natural (rock) substrates than on the ball baskets.

SEASONAL VARIATIONS IN SAMPLER EFFICIENCIES

In order to evaluate sampler efficiency changes between the sampling periods the number of taxa sampled for the most successful of each type of artificial substrate was plotted for each harvest date and compared against natural substrate samples. The information used for the plots is summarized in Table V.

Figure 1 shows the seasonal curves for the Wolf River habitat. A comparison of curves for combined total taxa, best ball sampler, best qualitative wood sampler and best plate sampler show little difference in trends. All these techniques show a decline from June to July-August and a slight decline from July-August to September. The qualitative rock however showed an increase at

TABLE V

MONTHLY FLUCTUATIONS IN MACROINVERTEBRATE POPULATIONS FOR EACH HABITAT AREA

	Number of Taxa					Average Number of Individuals per Sampler				
	Combined	Surber	Wood	Balls	Plate	Combined	Surber[a]	Wood	Balls	Plate
Tomorrow Riffle										
May	69	64	45	--	--	2151	1804	2498	--	--
June	53	49	32	39	35	1800	1230	1646	3070	1257
July	49	43	27	31	29	591	551	743	857	213
September	52	46	35	30	25	812	685	1070	1114	382
Tomorrow Pool										
May	63	49	35	--	--	--	1339	947	--	--
June	53	33	25	33	22	235	198	423	237	82
July	57	32	25	36	26	235	127	268	461	86
September	56	31	25	33	24	381	195	307	813	211
Wolf River										
May	63	50	33	--	--	--	203	1239	--	--
June	54	33	25	34	22	1873	286	3520	2412	1277
July	61	34	27	38	26	2096	1602	1810	3086	1888
September	58	35	27	34	24	4267	2406	5903	5641	3118

[a] Numbers for Wolf habitat in this column are for qualitative rock samples.

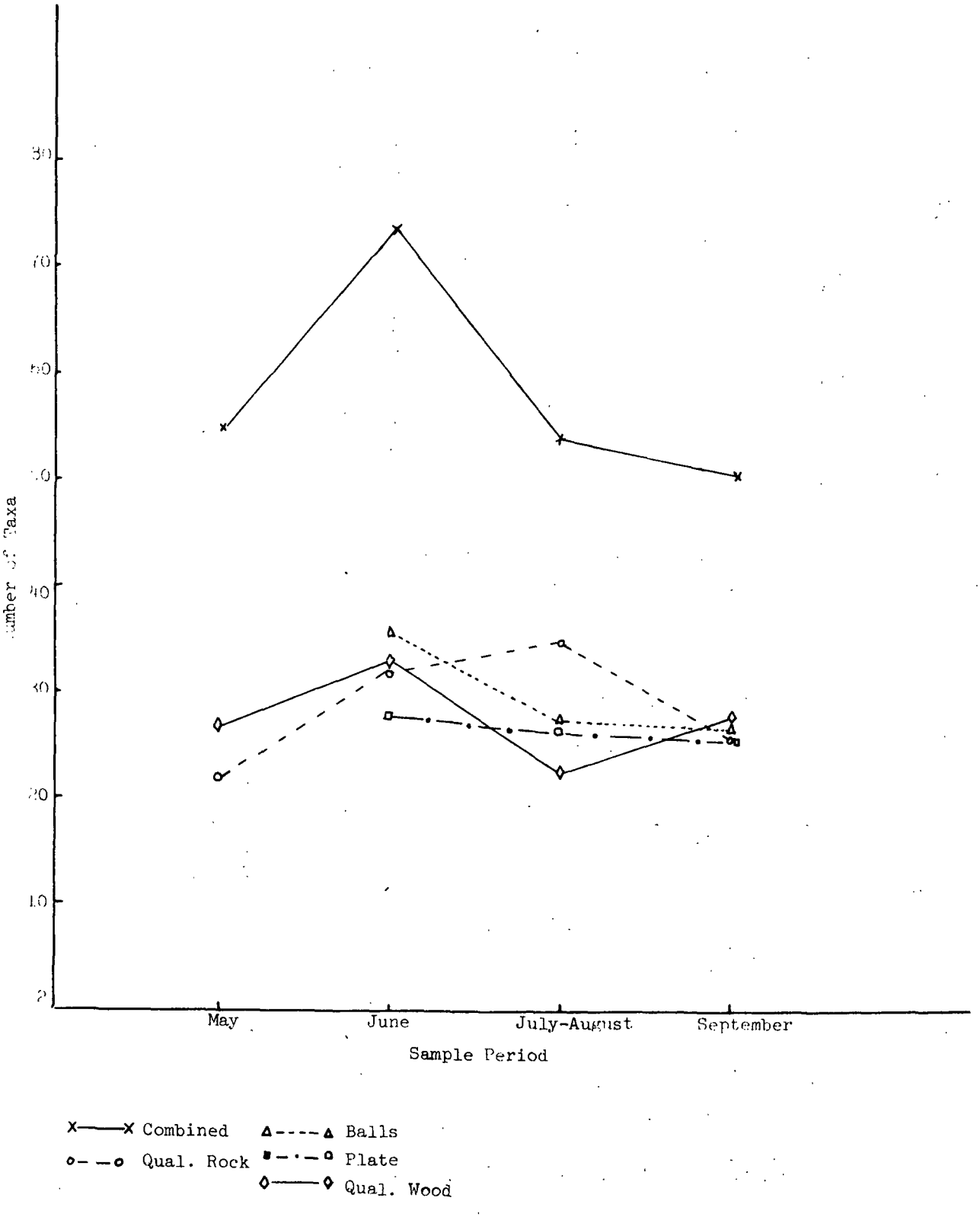

Figure 1. Curves for Seasonal Fluctuations in Number of Taxa Sampled for Combined Populations Compared with Major Sampler Types — Wolf Habitat

July-August and then a September decrease. The artificial substrates in this habitat did not display any change in relative efficiency when compared to total population fluctuations.

Figures 2 and 3 present similar comparisons for the two stations on the Tomorrow River. It can be seen that natural and artificial substrate samplers displayed similar curves for corresponding periods. Excepting the plate sampler, both natural and artificial samplers had similar slopes and amplitudes in the Tomorrow River Pool (Fig. 3). In the Tomorrow River riffle the curves are similar, excepting the plate sampler again, but the amplitudes are also different. The best Surber sampled more taxa at each harvest than did the ball or pate samplers. In both Tomorrow River habitats the best plate sampler was least successful in terms of number of taxa as compared to other sampling techniques. On the riffle the plate sampler showed a declining population in September when all other samplers showed an increasing or at least a stable population.

CLUSTER ANALYSIS

One of the major objectives of this study was the comparison of natural and artificial substrate samplers for three different habitat areas in terms of efficiency at sampling the resident population. One of the clearest ways of summarizing the sampler comparisons to provide this information was found to be the computer drawn dendograms in Fig. 4, 5, and 6. Using the modified Jacard coefficient for the Wolf River habitat data it can be seen that the plate sampler and ball samplers are highly correlated together as are the natural wood and qualitative rock substrate samples. The two pairs of samples cluster together between 0.9 and 1.0 which indicates that this is a very good similarity between the normally used natural substrates and the two experimental artificial substrates.

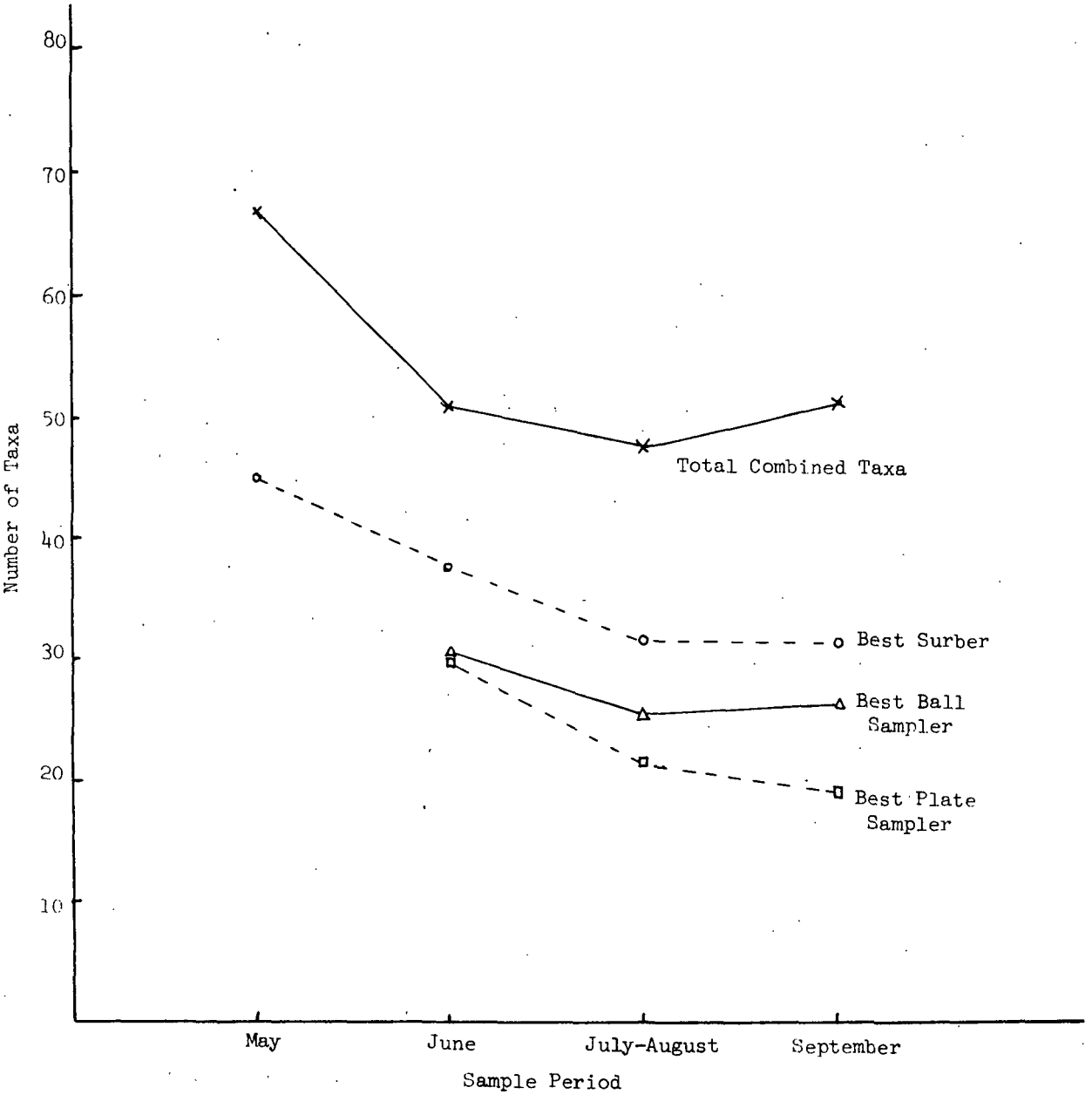

Figure 2. Curves for Seasonal Fluctuations in Number of Taxa Sampled for Combined Populations Compared with Major Sampler Types — Tomorrow River Habitat

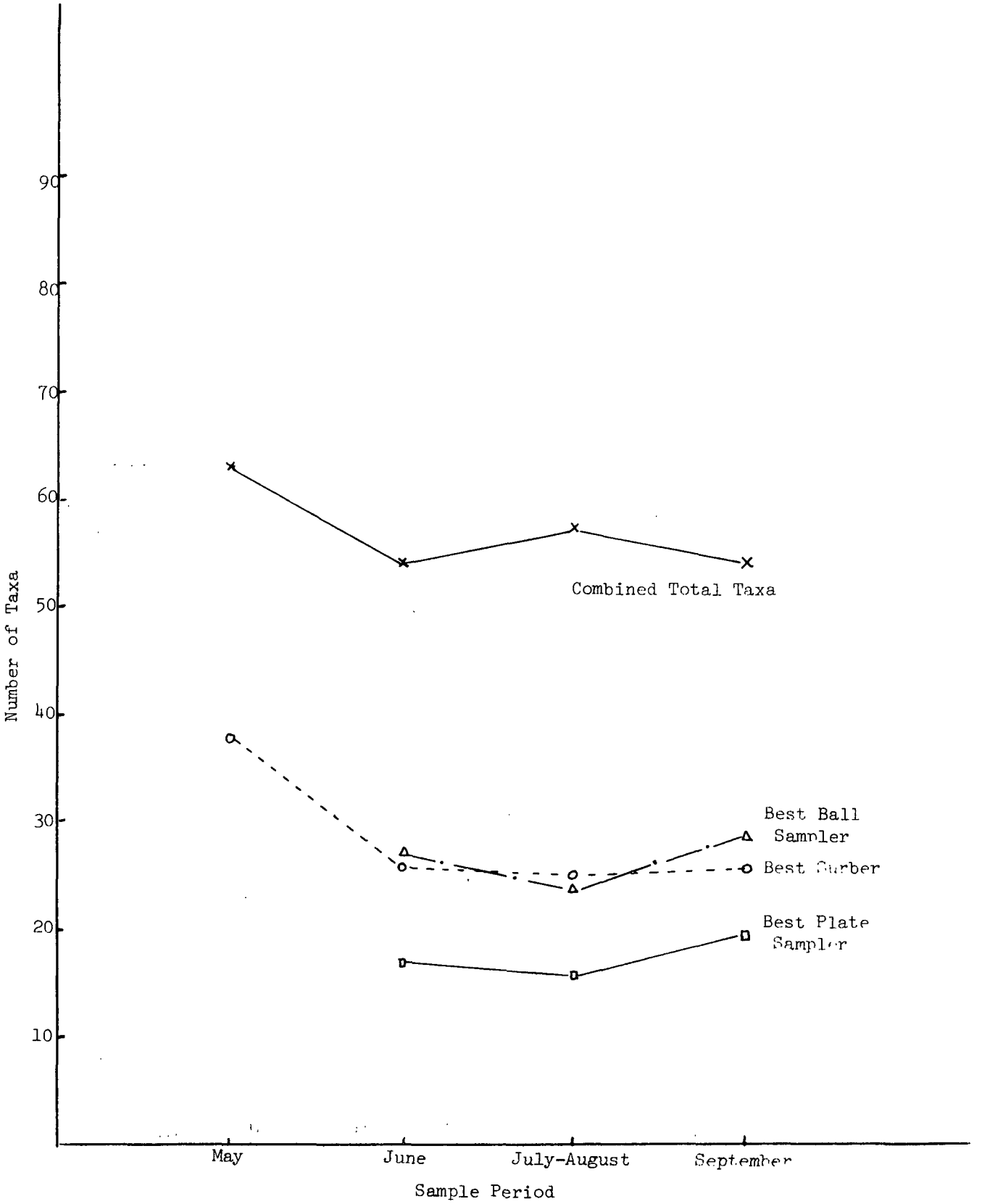

Figure 3. Curves for Seasonal Fluctuations in Number of Taxa Sampled for Combined Populations Compared with Major Sampler Types — Tomorrow Pool Habitat

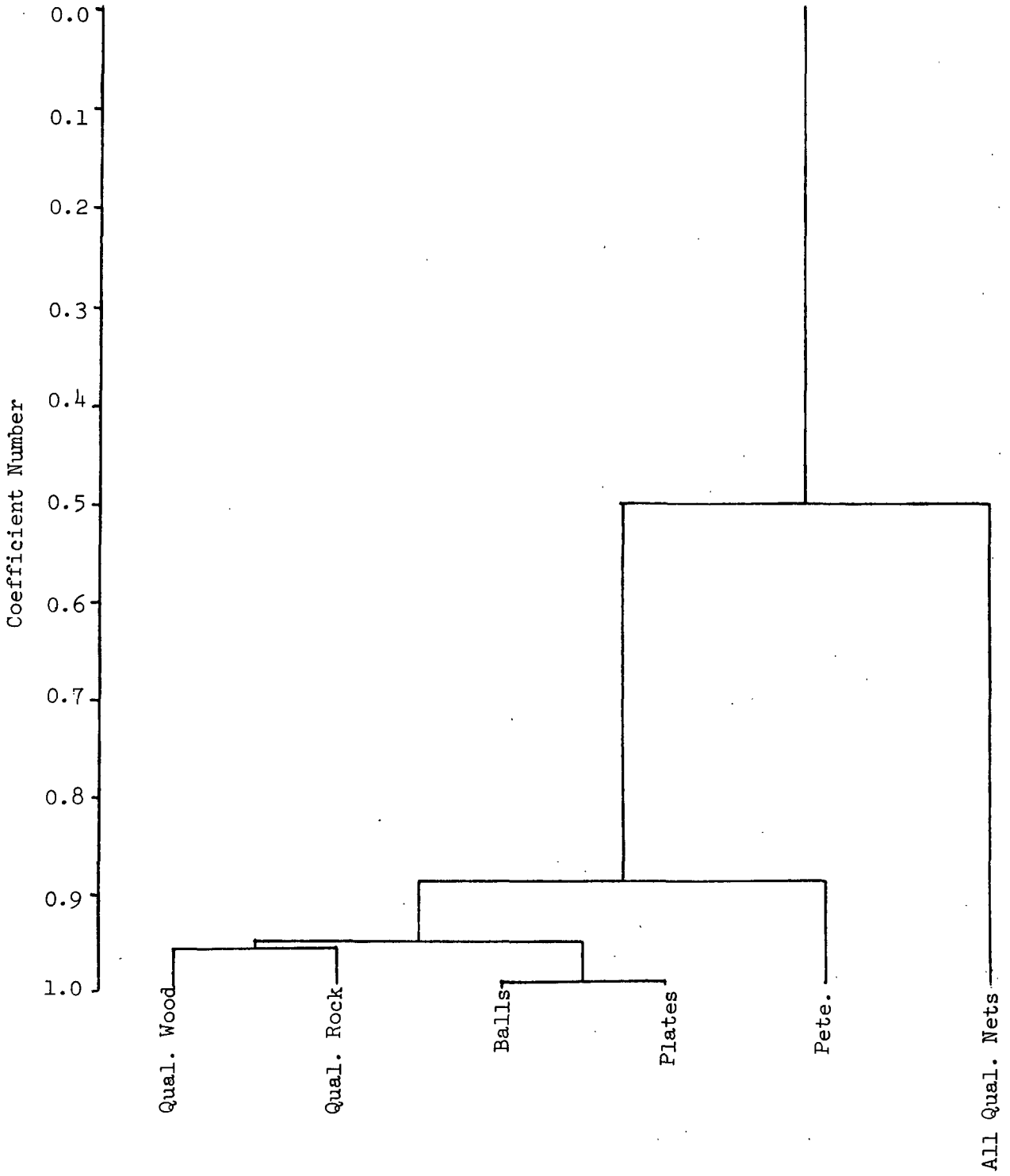

Figure 4. Dendogram of Cluster Analysis by Modified Jacard Coefficients of Similarity for Wolf Habitat Samplers

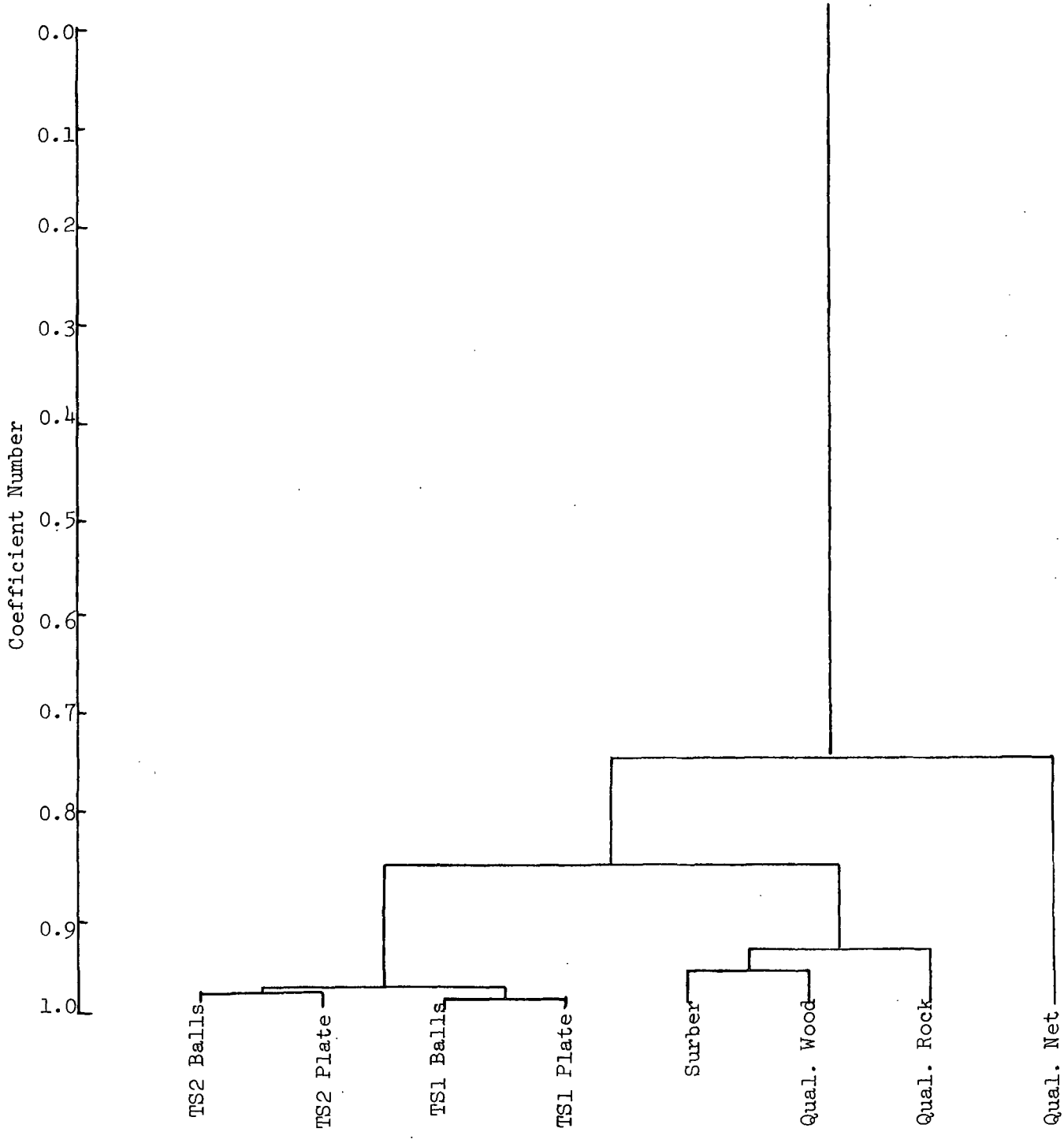

Figure 5. Dendogram of Cluster Analysis by Modified Jacard Coefficients of Similarity for Tomorrow River Riffle Samplers

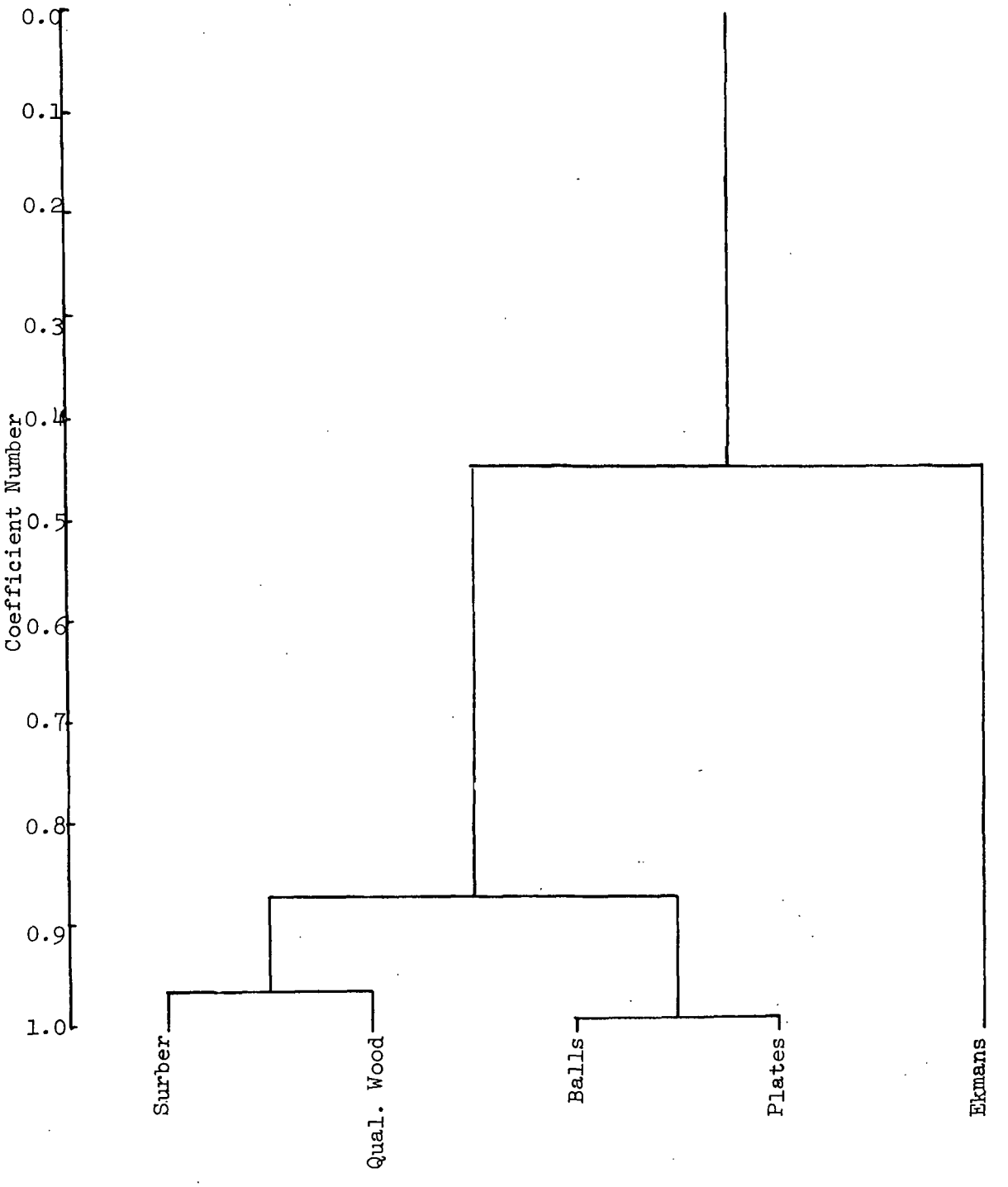

Figure 6. Dendogram of Cluster Analysis by Modified Jacard Coefficients of Similarity for Tomorrow River Pool Samplers

The Peterson and qualitative net samples clustered poorly with all other sampling techniques. Figure 5 is a dendogram for the Tomorrow River riffle data. In this comparison, both sets of balls and plates clustered together as did the Surber and qualitative wood natural substrate samples. However the cluster level between natural substrates and artificial substrates was lower in this habitat than it was in the Wolf River habitat previously discussed. Given this poorer comparison between natural and artificial substrate populations and the availability of natural substrates it can be further concluded that sampling artificial substrates would not be a preferred sampling technique for this shallow riffle habitat.

A similar situation existed for the Tomorrow River pool habitat. In Fig. 6 the correlations are best between the two artificial substrates and the two natural substrates but the natural and artificial substrates do not correlate together as well as they do for the Wolf River habitat. Again, based upon cluster analysis, the natural substrates are preferable in this habitat type for sampling the widest range of resident macroinvertebrates.

DIVERSITY INDEX

Because of the widespread use of numerical diversity indices to evaluate biological data this information was calculated for the present comparative study. Appendix II lists the calculated values of $\underline{\overline{D}}$ and $\underline{R}$. The curves in Fig. 7 represent the values of $\underline{\overline{D}}$ for each habitat area in this comparison study.

The major sampling types were evaluated and compared with a value calculated for the entire population as determined by combining all samples. As with other approaches to evaluating the artifical substrate sampler efficiency, comparisons within habitat types, or station locations, are most appropriate.

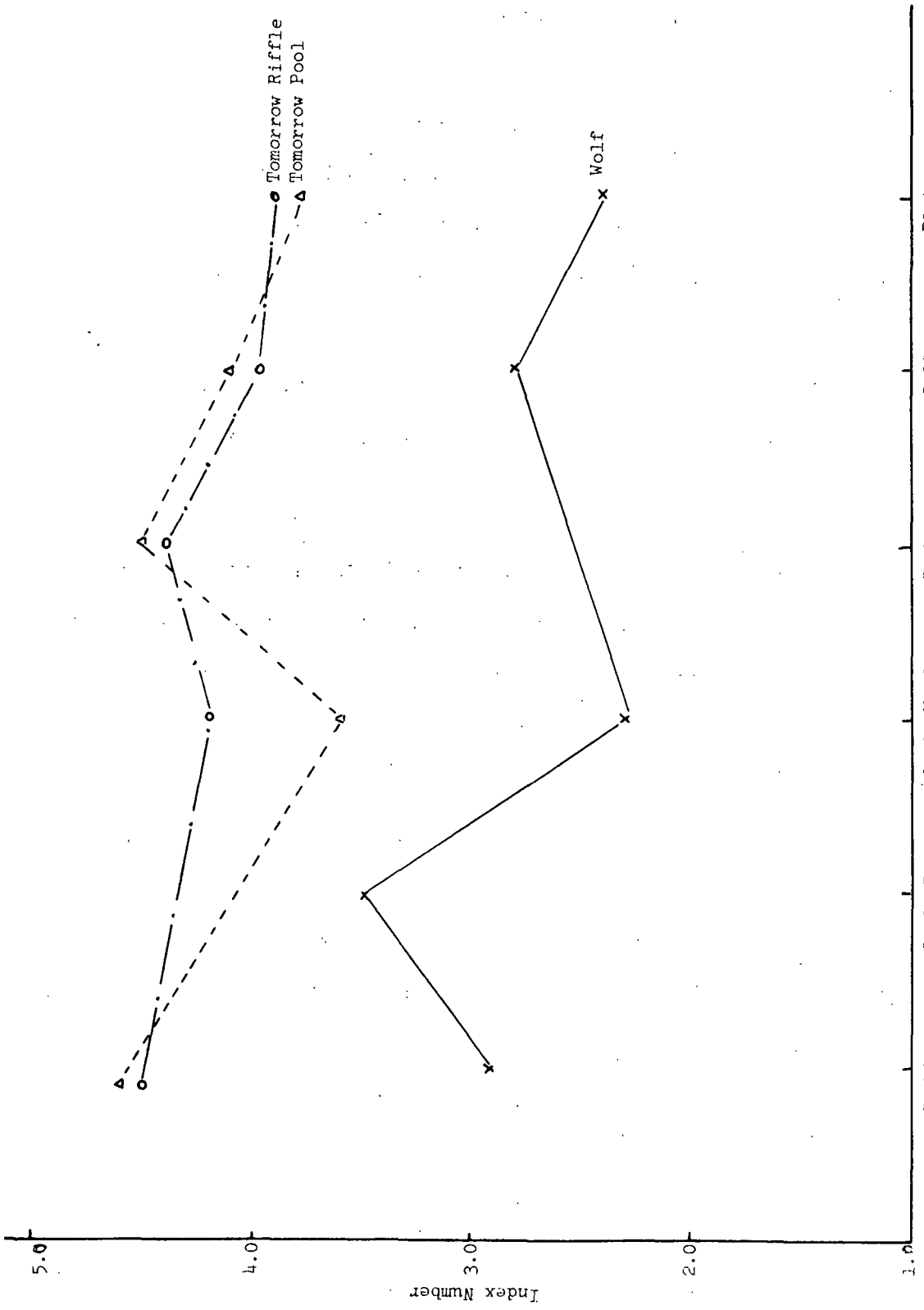

Figure 7. Diversity Index $\overline{D}$ Curves for all Habitat Areas and Sampler Types

From the appendix and Fig. 7 data it can be seen that the $\overline{D}$ diversity indices were consistently a little lower for plate samplers than for ball samplers. In all three habitat areas the artificial substrate index values were quite close to the combined population index. In the Tomorrow River Pool station and in the Wolf River station wider differences occurred between the natural substrates and between natural substrates compared to the combined population values than were seen for the artificial substrates.

Upon overall comparison the calculated diversity index does not show as great a difference between populations sampled by artificial substrates and populations sampled by natural substrates as was shown by the cluster analysis technique.

CONCLUSIONS

Based upon all analyses of the data available it was apparent that both artificial substrate samplers succeeded in sampling a representative portion of the resident macroinvertebrates in all three habitat areas investigated. Thus these samplers could be used in water quality investigations with reliability. However the artificial substrates in both the pool and riffle shallow stream habitats proved to be less efficient than other available techniques at sampling the resident community. Due to the accessibility of natural substrates in these two areas other sampling techniques should be used instead of artificial substrates where this is a simple choice. Complications such as multiple sampling by untrained personnel, may require that the simpler artificial substrate technique be preferred.

In the Wolf River habitat natural substrate sampling techniques were not significantly more efficient than the artificial substrates. In this habitat the artificial substrates provided the only means of obtaining quantitative data for the greatest portion of the lotic population and for this reason are superior to, and preferable to, natural substrate sampling.

It was also seen in this study that artificial substrates do sample the population which is resident to the sample area. One of the goals of this study was to determine whether populations on artificial substrates most resemble resident populations or populations present in downstream and upstream areas which may colonize the samplers by drift. In these study areas differences between habitat populations and upstream areas was probably not great enough to demonstrate differences due to colonization from upstream habitats. In the Wolf River a rather uniform habitat occurred for miles upstream from the sampling site. In the Tomorrow River lotic communities did not differ markedly between the swift rock riffles and

the slower "pool" runs as was initially suspected. Where differences did occur, little exchange of organisms was apparent on the artifical substrates. Further complications existed with the placement of samplers on the natural bottom in shallow habitats as opposed to suspending them in the current in deeper habitats. Suspended samplers may collect drift organisms more efficiently than bottom samplers and this subject could stand further investigation.

No seasonal changes in artificial substrate sampler efficiency was observed. Populations did change in the study areas over the sampling period but for the most part the artificial substrate populations changed in patterns similar to the total sampled population.

Predictably, the artificial substrates best sampled populations which colonized natural rock and wood substrates. Organisms sampled by dredge in sand and silt substrates and organisms sampled by dip net in vegetation near the waters surface were poorly sampled by artificial substrates. Since the majority of lotic organisms did occur on rock or wood, and since both commonly used natural substrates as well as the tested artificial substrates rely upon rock or wood substrates, these communities are suitable for water quality evaluations based upon population changes. However if more comprehensive studies are desired for productivity or substrate change information a combination of sampling techniques is advised to sample substrates not sampled by rock and wood samplers.

Artificial substrate samplers of the type described in this study exist as an acceptable or superior sampling technique in larger rivers where lotic communities are difficult to sample from natural substrates and where natural substrates are not strategically located. In other habitats these sampling techniques should not be preferred over natural substrate sampling techniques where a reasonable choice exists.

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APPENDIX I

COMPLETE COMPILATION OF INDIVIDUAL TAXA AND NUMBERS ACCUMULATED THROUGHOUT SAMPLER COMPARISON STUDY

Station 1. Tomorrow-Pool Habitat

Taxa	May					June									
	Surber	Surber	Wood Qual.	2 Ekman Silt	2 Ekman Sand	T 3 Ball	T 3 Plate	T 4 Ball	T 4 Plate	Surber	Surber	Wood Qual.	Ekman	Ekman	Ekman
Plecoptera															
Acroneuria ruralis	4	--	1	--	--	--	--	--	--	--	--	--	--	--	--
Perlesta placida	2	--	--	--	--	--	--	--	--	--	1	2	1	--	--
Pteronarcys (nobilis)	--	--	--	--	--	1	--	--	--	--	--	1	--	--	--
Ephemeroptera															
Baetis cingulatus	2	6	7	--	--	10	--	63	20	--	1	138	--	--	--
Baetis sp.	--	--	--	--	--	2	--	--	--	2	1	--	--	--	--
Ephemerella euterpe (?)	--	4	--	--	--	--	--	--	--	--	--	--	--	--	--
Ephemerella infrequens	2	4	2	--	--	--	--	--	--	--	--	--	--	--	--
Ephemerella needhami	--	--	3	--	--	--	--	--	--	--	--	--	--	--	--
Ephemerella needhami gp sp. ?	--	4	--	--	1	--	--	--	--	--	--	--	--	--	--
Ephoron sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Heptagenia sp.	10	12	13	--	--	20	4	15	10	2	11	80	--	--	--
Hexagenia sp.	--	--	--	12	--	--	--	--	--	--	--	--	--	15	16
Pseudocloeon carolina	--	--	7	--	--	--	--	--	--	--	1	--	--	--	--
Pseudocloeon cingulatum	--	8	7	--	--	4	--	--	--	--	--	--	--	--	--
Pseudocloeon punctiventris	6	6	17	--	--	5	--	9	--	--	1	10	--	--	--
Siphlonurus sp.	--	--	--	--	--	--	--	2	--	--	--	--	--	--	--
Stenonema sp. 1	46	36	58	--	--	9	4	13	6	--	9	50	--	--	--
Stenonema sp. 2	12	--	28	--	--	--	1	1	--	--	--	--	--	--	--
Stenonema sp. 3	36	--	--	--	--	7	--	1	1	--	2	20	2	--	--
Tricorythodes sp.	2	--	1	--	--	1	--	1	1	1	1	--	--	--	--
Trichoptera															
Agapetus sp.	2	2	--	--	--	--	--	--	--	--	--	--	--	--	--
Agraylea sp.	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Athripsodes sp.	--	2	--	--	--	--	--	1	--	--	--	--	--	--	--
Brachycentrus americanus	--	--	2	--	--	--	--	--	--	--	--	--	--	--	--
Cheumatopsyche sp.	30	4	--	--	--	1	--	--	--	4	2	8	--	--	--
Helicopsyche sp.	8	2	--	--	--	--	--	2	--	2	--	--	--	--	--
Hydropsyche sp.	50	24	76	--	--	--	--	1	--	7	--	6	--	--	--
Hydropsyche sp. 2	--	2	10	--	--	--	--	--	--	--	--	--	--	--	--
Hydropsyche sp. 3	82	94	24	--	--	--	--	1	--	16	3	9	--	--	--
Neophylax sp.	50	20	6	--	--	--	6	--	--	--	3	3	--	--	--
Polycentropus sp.	--	--	2	--	--	--	--	--	--	--	--	--	--	--	--
Protoptila sp.	10	34	--	--	--	--	--	--	--	--	--	--	--	--	--
Psychomyia flavida	122	314	256	--	--	1	--	2	2	40	12	7	--	--	--
Pycnopsyche sp.	2	--	10	--	--	10	--	1	--	1	1	10	--	--	--
Turbellaria															
Unidentified genus	6	26	--	--	--	--	--	--	--	--	--	1	--	--	--
Amphipoda															
Gammarus sp.	94	2	8	--	--	27	10	4	4	24	8	30	--	--	--
Coleoptera															
Ectopria sp.	--	2	--	--	--	--	--	--	--	--	--	--	--	--	--
Helodidae sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Macronychus glabratus	--	--	4	--	--	--	--	--	--	--	--	--	--	--	--
Microcylloepus sp.	--	4	--	--	--	--	--	--	--	--	--	--	--	--	--
Promoresia sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Stenelmis sp.	16	8	4	--	--	--	--	--	--	2	2	1	--	--	--
Isopoda															
Asellus sp.	--	--	--	--	--	8	4	4	2	2	1	1	--	--	--
Decapoda															
Orconectes illinoiensis	--	--	--	--	--	1	--	1	--	--	--	--	--	--	--
Orconectes sp. 2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Unident. immature O	2	--	--	--	--	6	2	3	2	1	--	--	--	--	--

APPENDIX I (Continued)

COMPLETE COMPILATION OF INDIVIDUAL TAXA AND NUMBERS ACCUMULATED THROUGHOUT SAMPLER COMPARISON STUDY

Station 1 (Continued). Tomorrow-Pool Habitat

Taxa	May					June									
	Surber	Surber	Wood Qual.	2 Ekman Silt	2 Ekman Sand	T 3 Ball	T 3 Plate	T 4 Ball	T 4 Plate	Surber	Surber	Wood Qual.	Ekman	Ekman	Ekman
Odonata															
Erpetogomphus sp.	--	--	--	--	--	--	--	--	--	1	--	--	--	--	--
Unident. Zygoptera	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--
Hemiptera															
Lethocerus sp.	--	--	--	--	--	1	2	--	--	--	--	--	--	--	--
Limnogonus sp.	--	--	--	--	--	--	1	--	--	--	--	--	--	--	--
Diptera															
Antocha sp.	228	494	38	--	--	--	--	--	--	32	--	1	--	--	--
Cardiocladius sp.	--	--	--	--	--	--	--	1	--	--	--	--	--	--	--
Cladotanytarsus sp.	--	--	--	--	--	--	3	3	1	54	--	--	50	2	6
Conchapelopia sp.	--	--	--	--	--	--	--	6	--	--	--	--	--	--	--
Corynoneura sp.	--	--	2	--	--	8	1	48	4	6	--	16	--	--	--
Cricotopus sp.	--	--	--	--	--	45	8	30	22	16	10	5	--	--	--
Cricotopus sp. 2	6	2	8	--	1	--	--	--	--	--	--	--	58	--	--
Cryptochironomus sp.	--	--	--	6	--	--	--	--	--	--	--	--	--	--	--
Diamesa sp.	--	2	--	--	--	--	--	--	--	--	--	--	--	--	--
Endochironomus sp.	--	--	--	--	--	--	--	--	--	--	--	1	1	--	--
Eukiefferiella sp.	--	--	--	--	--	--	--	--	--	4	--	--	--	--	--
Eukiefferiella sp. 2	--	20	4	--	--	--	--	--	--	--	--	--	--	--	--
Hemerodromia sp.	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Kiefferulus sp.	--	--	--	--	--	--	--	--	--	--	--	--	21	5	
Larsia sp.	--	2	--	--	--	--	--	--	--	--	5	--	--	--	--
Microtendipes sp.	10	--	--	--	--	--	--	--	--	49	--	1	--	--	--
Nilotanypus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Odontomyia sp.	--	--	--	3	--	--	--	--	--	--	--	--	--	--	--
Orthocladius sp.	88	186	198	--	1	--	--	--	--	--	--	--	--	--	--
Polypedilum fallax	2	2	--	--	27	--	--	--	--	--	--	--	--	--	--
Polypedilum sp.	136	70	84	--	1	37	7	31	25	14	9	18	48	--	--
Procladius sp.	--	--	--	6	--	--	--	--	--	--	--	--	--	5	2
Prosimulium sp.	--	--	4	--	--	4	1	3	--	--	--	--	--	--	--
Pseudodiamesa pertinax	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--
Rheotanytarsus sp.	24	30	10	--	--	--	--	--	--	--	1	--	--	--	--
Tanytarsus sp.															
Stictochironomus sp.	--	--	--	--	--	2	--	1	1	2	--	--	16	18	110
Tabanus sp.	--	--	--	3	--	--	--	--	--	--	--	--	--	--	--
Thienemaniella sp.	24	8	34	--	--	--	--	--	--	--	--	--	--	--	--
Unident. Tipulidae	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Gastropoda															
Ferrissia sp.	4	6	--	--	--	2	--	--	1	2	--	--	--	--	--
Physa sp.	--	2	--	--	--	--	--	--	--	--	--	--	--	--	--
Oligochaeta															
Arcteonais lomondi	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6
Limnodrilus hoffmeisteri	--	--	--	--	--	--	--	--	--	--	--	--	--	240	112
Nais behingi	38	54	16	3	--	10	4	1	1	28	--	3	--	--	--
Nais bretscheri	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nais sp.	2	4	2	--	--	--	--	--	--	--	--	--	--	--	--
Rhyacodrilus coccineus	4	--	--	3	--	3	3	--	--	--	--	--	--	3	159
Unident. immature without Cappiliform chaetae	--	--	--	6	1	--	--	--	--	--	--	--	--	--	--
Hirudinea															
Erpobdella triannulata	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Glossiphonidae sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Placobdella parasitica	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Taxa	38	37	34	8	6	25	17	27	16	26	21	25	7	7	8
Total Individuals	1172	1506	947	42	32	225	61	249	103	312	85	423	176	304	417
Total Taxa by Month	May = 63					June = 54									
Total Taxa by Sampler Type	Surber 65		Qual. Wood 49		Ekman 27	Ball T 3	Plate T 3	Ball T 4	Plate T 4	Combined Ball		Combined Plate			
% of Total	71		50		29	40	30	40	33	50		38			
						43	32	43	35	54		41			
Sample as % Total Taxa	41	40	36	8	6	27	18	29	17	28	22	27	7	7	8

APPENDIX I (Continued)

COMPLETE COMPILATION OF INDIVIDUAL TAXA AND NUMBERS ACCUMULATED THROUGHOUT SAMPLER COMPARISON STUDY

Station 1 (Continued). Tomorrow-Pool Habitat

Taxa	July									September									
	T 3 Ball	T 3 Plate	T 4 Ball	T 4 Plate	Surber	Surber	Wood Qual.	Ekman Silt 2 Grabs	Ekman Sand	T 3 Ball	T 3 Plate	T 4 Ball	T 4 Plate	Surber	Surber	Wood Qual.	Ekman	Ekman	Ekman
Plecoptera																			
Acroneuria ruralis	--	--	--	1	--	--	7	--	--	--	--	4	2	--	--	5	--	--	--
Perlesta placida	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pteronarcys (nobilis)	--	--	--	--	--	--	1	--	--	1	1	--	--	--	--	8	--	--	--
Ephemeroptera																			
Baetis cingulatus	18	3	51	65	3	7	73	--	--	30	16	288	94	1	10	103	--	--	--
Baetis sp.	7	--	33	12	4	2	21	--	--	24	17	312	44	5	9	96	--	--	--
Ephemerella euterpe (?)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ephemerella infrequens	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ephemerella needhami	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ephemerella needhami gp sp.?	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ephoron sp.	--	--	--	--	--	--	--	--	--	1	--	--	--	--	--	--	--	--	--
Heptagenia sp.	1	--	--	--	5	8	12	--	--	4	--	4	--	2	7	3	--	--	--
Hexagenia sp.	--	--	9	--	--	--	--	1	--	--	--	--	--	--	--	--	--	--	3
Pseudocloeon carolina	1	--	--	1	2	--	--	--	--	--	1	--	--	--	--	1	--	--	--
Pseudocloeon cingulatum	--	--	--	--	--	--	--	--	--	--	--	--	4	--	--	1	--	--	--
Pseudocloeon punctiventris	--	--	1	1	--	--	10	--	--	3	2	40	2	1	--	1	--	--	--
Siphlonurus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Stenonema sp. 1	5	1	15	11	5	5	20	--	--	2	--	--	6	4	7	--	--	--	--
Stenonema sp. 2	--	1	--	--	--	--	6	--	--	12	3	8	--	11	10	9	--	--	--
Stenonema sp. 3	14	1	30	23	4	6	28	--	--	34	9	112	68	7	20	25	--	--	--
Tricorythodes sp.	--	--	--	--	--	1	--	--	--	3	--	--	2	1	--	--	--	--	--
Trichoptera																			
Agapetus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--
Agraylea sp.	--	--	--	--	--	--	--	--	--	1	--	--	--	--	--	--	--	--	--
Athripsodes sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Brachycentrus americanus	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cheumatopsyche sp.	4	--	12	1	2	6	--	--	--	1	--	32	2	1	8	1	--	--	--
Helicopsyche sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--
Hydropsyche sp.	1	--	9	1	--	1	--	--	--	16	--	76	16	--	--	2	--	--	--
Hydropsyche sp. 2	--	--	2	2	--	--	--	--	--	1	--	10	3	--	--	--	--	--	--
Hydropsyche sp. 3	4	--	28	11	5	9	6	--	--	16	3	74	27	2	16	23	--	--	--
Neophylax sp.	--	--	--	--	7	17	2	--	--	--	--	--	--	31	14	--	--	--	--
Polycentropus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Protoptila sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Psychomyia flavida	--	--	--	--	2	6	--	--	--	1	--	4	--	3	12	1	--	--	--
Pycnopsyche sp.	8	6	1	--	2	1	15	--	1	--	--	--	--	--	--	3	--	--	--
Turbellaria																			
Unidentified genus	--	--	1	--	3	5	1	--	--	--	--	--	--	12	1	--	--	--	--
Amphipoda																			
Gammarus sp.	90	4	--	--	12	7	33	--	--	26	1	--	--	12	19	7	--	--	--
Coleoptera																			
Ectopria sp.	--	--	--	--	--	2	--	--	--	--	--	--	--	3	1	--	--	--	--
Helodidae sp.	--	--	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--
Macronychus glabratus	--	--	--	--	--	--	2	--	--	--	--	--	--	--	--	--	--	--	--
Microcylloepus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Promoresia sp.	--	--	--	--	--	1	--	--	--	--	--	--	--	--	3	--	--	--	--
Stenelmis sp.	--	--	1	1	8	--	8	--	--	--	--	2	--	3	6	1	--	--	--
Isopoda																			
Asellus sp.	4	--	1	--	--	--	--	--	--	--	--	--	--	2	--	--	--	--	--
Decapoda																			
Orconectes illinoiensis	--	3	--	--	--	--	--	--	--	10	--	1	--	--	--	--	--	--	--
Orconectes sp. 2	--	--	1	--	--	--	--	--	--	--	--	1	--	--	--	--	--	--	--
Unident. immature O	8	--	--	1	--	--	--	--	--	--	--	1	--	1	1	--	--	--	--

APPENDIX I (Continued)

COMPLETE COMPILATION OF INDIVIDUAL TAXA AND NUMBERS ACCUMULATED THROUGHOUT SAMPLER COMPARISON STUDY

Station 1 (Continued). Tomorrow-Pool Habitat

Taxa	July									September									
	T 3 Ball	T 3 Plate	T 4 Ball	T 4 Plate	Surber	Surber	Wood Qual.	Ekman Silt 2 Grabs	Ekman Sand	T 3 Ball	T 3 Plate	T 4 Ball	T 4 Plate	Surber	Surber	Wood Qual.	Ekman	Ekman	Ekman
Odonata																			
Erpetogomphus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Unident. Zygoptera	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hemiptera																			
Lethocerus sp.	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Limnogonus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Diptera																			
Antocha sp.	4	--	2	1	13	25	1	--	--	2	9	16	2	22	22	1	--	--	--
Cardiocladius sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cladotanytarsus sp.	--	--	--	--	--	5	--	--	3	--	--	--	--	--	--	--	--	--	--
Conchapelopia sp.	--	--	--	--	--	--	--	--	--	3	--	--	--	1	--	--	--	--	--
Corynoneura sp.	1	1	3	--	1	--	3	--	--	21	7	46	8	3	16	3	--	--	--
Cricotopus sp.	--	1	5	--	--	--	--	--	--	120	18	62	23	13	25	4	--	--	--
Cricotopus sp. 2	10	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cryptochironomus sp.	--	--	--	--	--	--	--	5	--	--	--	--	--	--	--	--	--	--	--
Diamesa sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Endochironomus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Eukiefferiella sp.	--	--	2	--	--	--	1	--	--	2	--	2	3	--	--	--	--	--	--
Eukiefferiella sp. 2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hemerodromia sp.	--	--	--	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	1
Kiefferulus sp.	2	--	--	--	--	--	--	1	--	--	--	--	--	--	5	--	--	--	--
Larsia sp.	2	--	--	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--
Microtendipes sp.	--	--	--	--	8	12	--	--	--	--	--	--	--	4	--	1	--	--	--
Nilotanypus sp.	--	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Odontomyia sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Orthocladius sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Polypedilum fallax	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Polypedilum sp.	2	4	7	2	7	8	13	--	--	23	5	36	1	6	4	4	--	--	--
Procladius sp.	1	--	--	--	--	--	--	2	--	--	--	--	--	--	--	--	--	--	1
Prosimulium sp.	--	--	6	3	--	--	1	--	--	3	1	76	15	--	--	1	--	--	--
Pseudodiamesa pertinax	--	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--	--	--
Rheotanytarsus sp.	--	--	4	--	5	--	--	--	--	7	3	20	5	--	7	2	--	--	--
Tanytarsus sp.	11	--	--	--	--	1	--	2	15	--	--	--	--	6	--	--	--	--	1
Stictochironomus sp.	--	--	--	--	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--
Tabanus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Thienemaniella sp.	--	--	--	--	--	--	--	5	--	--	--	--	--	--	--	--	5	1	--
Unident. Tipulidae	--	--	--	--	--	--	--												
Gastropoda																			
Ferrissia sp.	10	3	--	--	8	2	1	--	--	26	--	--	--	--	6	--	--	--	--
Physa sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Oligochaeta																			
Arcteonais lomondi	--	--	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--
Limnodrilus hoffmeisteri	369	5	--	--	1	--	--	1	3	--	--	--	--	--	--	--	--	2	10
Nais behingi	--	--	--	--	4	--	1	--	--	--	--	--	--	--	--	1	--	--	--
Nais bretscheri	--	--	--	--	--	--	--	--	--	2	--	--	--	2	--	--	--	--	--
Nais sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	158
Rhyacodrilus coccineus	120	3	--	--	--	3	--	13	--	3	--	--	--	--	--	--	--	--	--
Unident. immature without Cappiliform chaetae	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hirudinea																			
Erpobdella triannulata	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Glossiphonidae sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--
Placobdella parasitica	--	--	--	--	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--
Total Taxa	24	14	24	16	23	25	25	10	4	29	15	23	20	26	25	25	1	2	6
Total Individuals	697	36	226	137	112	142	268	32	22	398	95	1228	328	159	231	307	5	4	174
Total Taxa by Month	July = 57									Sept. = 55									
Total Taxa by Sampler Type	Combined 38	Plate 41																	
% of Total Sample as % Total Taxa	26	15	26	17	25	27	27	10	4	31	16	25	21	28	27	27	1	2	6

APPENDIX I (Continued)

COMPLETE COMPILATION OF INDIVIDUAL TAXA AND NUMBERS ACCUMULATED THROUGHOUT SAMPLER COMPARISON STUDY

Station 2. Tomorrow Riffle Habitat

Taxa	May						June									
	Surber	Surber	Surber	Surber	Qual. Wood	T 2 Qual. Rock	T 1 Balls	T 1 Plate	T 1 Surber	T 1 Surber	T 1 Qual. Wood	T 2 Ball	T 2 Plate	T 2 Surber	T 2 Surber	T 1 Qual Net
Plecoptera																
Acroneuria ruralis	2	1	1	--	6	6	3	--	--	31	3	6	1	4	4	--
Acroneuria sp. b	--	--	--	--	--	--	--	--	--	1	--	--	--	--	--	--
Perlesta placida	--	--	--	--	6	1	11	3	10	10	3	6	28	--	4	--
Pteronarcys (nobilis)	--	--	--	--	4	3	1	--	1	1	--	4	6	--	--	--
Togoperla sp. a (Rossi)	--	1	--	1	14	1	--	3	--	--	1	--	--	--	--	--
Ephemeroptera																
Baetis cingulatus	20	3	6	3	38	24	19	12	18	10	30	45	10	--	8	4
Baetis sp.	--	--	--	--	--	--	51	4	6	14	27	36	28	--	--	18
Ephemera sp.	--	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ephemerella euterpe (?)	6	3	1	4	--	--	--	--	--	--	--	--	--	--	--	--
Ephemerella infrequens	4	5	3	4	2	4	1	--	28	--	3	--	--	--	--	--
Ephemerella needhami	10	1	1	2	12	48	--	--	--	--	--	--	--	--	--	--
Ephemerella needhami gp sp.?	4	3	--	--	--	4	--	--	--	--	--	--	--	--	--	--
Ephoron sp.	--	--	--	--	--	--	--	--	--	1	--	--	--	--	--	--
Habrophlebiodes sp.	--	--	1	1	--	--	--	--	--	--	--	--	--	--	--	--
Heptagenia sp.	--	--	--	--	--	12	27	9	28	116	24	40	8	108	72	--
Isonychia albomanicata	--	--	--	--	--	--	--	--	--	--	--	--	--	--	8	--
Pseudocloeon carolina	8	3	4	7	54	88	21	4	8	--	12	3	4	16	4	4
Pseudocloeon cingulatum	20	3	3	7	27	272	23	10	8	4	39	18	--	--	--	6
Pseudocloeon punctiventris	32	3	1	4	40	28	7	17	10	4	21	27	34	6	8	180
Stenonema sp. 1	2	18	12	6	40	92	63	39	12	120	27	45	24	76	36	--
Stenonema sp. 2	--	--	--	--	28	4	4	--	2	--	--	--	--	--	--	--
Stenonema sp. 3	6	--	--	--	--	--	17	7	2	4	3	3	28	14	6	--
Tricorythodes sp.	--	--	1	--	1	4	1	--	--	2	--	12	14	--	--	6
Trichoptera																
Agapetus sp.	16	6	14	6	23	4	--	--	--	--	--	--	--	--	--	--
Agraylea sp.	--	--	--	8	2	4	--	--	--	--	--	--	--	--	--	--
Athripsoides sp.	--	--	--	--	--	1	--	--	--	--	--	--	--	--	--	--
Brachycentrus americanus	--	2	4	--	--	--	3	--	--	2	--	--	--	--	--	--
Brachycentrus lateralis	--	--	--	--	--	--	--	1	--	--	--	3	--	--	--	1
Cheumatopsyche sp.	50	21	30	12	28	12	759	45	90	66	87	129	612	52	70	2
Chimarra socia	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Helicopsyche sp.	--	2	2	--	9	--	--	--	--	2	2	--	--	--	--	--
Hydropsyche sp. 1	114	68	100	28	263	196	21	2	24	12	24	--	6	26	20	--
Hydropsyche sp. 2	104	5	20	4	52	168	39	7	3	12	102	18	3	2	--	--
Hydropsyche sp. 3	120	113	168	62	96	124	333	90	51	90	195	228	201	52	28	4
Leucotrichia sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Neophylax sp.	98	204	122	194	175	328	--	--	168	282	1	--	--	34	86	--
Neotrichia sp.	--	--	2	--	--	--	--	--	--	--	--	--	--	--	--	--
Oecetis cinerescens	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Protoptila sp.	28	33	24	64	--	16	--	--	--	--	--	--	--	--	--	--
Psychomyia flavida	66	141	62	126	28	192	12	59	333	108	60	6	3	66	76	--
Pycnopsyche sp.	--	5	--	--	60	--	--	--	--	--	1	--	--	--	--	--
Triaenodes sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Turbellaria																
Unidentified genus	16	--	--	10	2	--	--	--	18	22	--	1	--	1	2	--
Amphipoda																
Gammarus sp.	12	7	26	6	120	1	16	2	18	16	3	5	10	1	17	1
Coleoptera																
Dubiraphia sp.	--	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ectopria sp.	--	--	1	--	--	--	--	--	--	--	--	--	--	--	1	--
Macronychus glabratus	--	--	--	--	9	--	--	--	--	--	--	--	--	--	--	--
Microcylloepus sp.	34	8	16	10	3	--	--	--	--	--	--	--	--	--	--	--
Optioservus sp.	--	--	--	--	--	--	--	--	2	8	--	--	--	--	2	--
Promoresia sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Rhizelmis sp.	--	--	--	--	3	--	--	--	--	--	--	--	--	--	--	--
Stenelmis sp.	96	29	61	46	11	3	--	1	54	58	2	1	3	1	23	--
Isopoda																
Asellus sp.	--	2	--	--	9	--	12	2	--	4	5	6	11	--	5	--

APPENDIX I (Continued)

COMPLETE COMPILATION OF INDIVIDUAL TAXA AND NUMBERS ACCUMULATED THROUGHOUT SAMPLER COMPARISON STUDY

Station 2 (Continued). Tomorrow Riffle Habitat

	May						June									
Taxa	Surber	Surber	Surber	Surber	Qual. Wood	T 2 Qual. Rock	T 1 Balls	T 1 Plate	T 1 Surber	T 1 Surber	T 1 Qual. Wood	T 2 Ball	T 2 Plate	Surber	Surber	T 1 Qual. Net
Decapoda																
Orconectes illinoiensis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Orconectes sp. 2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Unident. immature 0	4	--	1	1	--	--	4	--	--	2	--	1	--	2	--	--
Diptera																
Antocha sp.	340	257	358	216	51	156	--	--	92	92	11	--	1	15	32	--
Atherix sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cardiocladius sp.	--	--	--	--	--	--	216	17	42	22	66	45	15	5	9	7
Cladotanytarsus sp.	--	2	--	--	--	--	--	--	42	18	--	6	6	--	7	--
Coryoneura sp.	--	--	2	6	10	--	108	8	.6	4	3	18	9	--	3	--
Cricotopus sp. 1	498	293	216	170	604	2416	204	40	99	58	45	33	60	3	8	38
Cricotopus sp. 2		--	--	--	4	48	--	--	--	--	--	--	--	--	--	--
Diamesa sp.	--	7	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Eukiefferiella sp. 1	22	16	8	6	39	2416	744	57	72	70	66	267	273	4	14	3
Eukiefferiella sp. 2	90	22	50	50	166	848	--	--	--	--	3	--	--	--	--	--
Hemerodromia sp.	2	3	2	2	3	--	--	--	--	--	--	--	--	--	--	--
Larsia sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Microtendipes sp.	12	--	--	4	--	--	--	--	33	6	--	--	--	--	2	--
Nilotanypus sp.	--	3	--	--	--	16	--	--	--	--	--	--	--	--	--	--
Orthocladius sp.	--	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Polypedilum fallax	18	15	2	20	--	--	--	--	--	--	--	--	--	--	--	--
Polypedilum sp.	318	234	164	154	224	592	456	24	264	220	108	243	503	27	53	--
Prosimulium sp.	6	18	2	--	9	12	1572	86	--	2	69	44	21	--	2	112
Pseudodiamesa pertinax	--	--	--	--	--	--	--	--	--	10	--	6	15	--	--	--
Rheotanytarsus sp.	22	70	12	42	5	32	--	--	--	--	--	--	--	--	--	1
Tanytarsus sp.																
Stratiomyiidae sp.	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Stictochironomus sp.	--	--	--	--	--	--	--	3	12	--	--	--	3	--	--	--
Thienemaniella sp.	14	15	12	8	70	48	--	--	--	--	--	--	--	--	--	--
Gastropoda																
Ferrissia sp.	--	2	--	2	3	--	--	--	--	--	--	--	--	--	--	--
Pelecypoda																
Sphaerium sp.	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Oligochaeta																
Nais behingi	--	--	40	134	134	336	--	--	753	152	600	51	21	--	5	--
Nais bretscheri	126	214	64	--	--	--	--	--	--	--	--	--	--	--	--	--
Nais communis	--	--	2	--	9	--	--	--	--	--	--	--	--	--	--	--
Nais sp.	12	--	--	--	2	--	36	2	--	--	--	--	--	--	--	--
Limnodrilus hoffmeisteri	--	--	--	--	--	--	--	--	15	--	--	--	--	--	--	--
Rhyacodrilus coccineus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Unident. immature without Cappiliform chaetae	4	4	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Taxa	40	45	41	41	45	38	30	27	33	38	32	31	30	21	16	15
Total Individuals	2296	1869	1621	1430	2498	8560	4784	554	2164	1656	1646	1356	1961	515	587	440

Total Taxa by Month: May = 67 — 75%; June = 51 — 57%

Total Taxa by Sampler Type:

	Surber	Qual. Wood	Qual. Rock	T 1 Balls	T 2 Balls	Combined Balls	T 1 Plate	T 2 Plate
	78	55	38	38	39	44	32	36
% of Total	87	61	42	42	43	49	35	40

Sample as % Total Taxa	44	50	46	46	50	42	33	30	37	42	35	34	33	23	17	16

APPENDIX I (Continued)

COMPLETE COMPILATION OF INDIVIDUAL TAXA AND NUMBERS ACCUMULATED THROUGHOUT SAMPLER COMPARISON STUDY

Station 2 (Continued). Tomorrow Riffle Habitat

	July										September									
Taxa	T 1 Balls	T 1 Plate	T 1 Surber	T 1 Surber	T 1 Wood Qual.	T 1 Net Qual.	T 2 Ball	T 2 Plate	T 2 Surber	T 2 Surber	T 1 Ball	T 1 Plate	T 1 Surber	T 1 Surber	T 1 Wood Qual.	T 1 Net Qual.	T 2 Ball	T 2 Plate	T 2 Surber	T 2 Surber
Plecoptera																				
Acroneuria ruralis	13	10	16	18	33	--	7	7	8	10	12	7	15	2	52	--	6	9	16	5
Acroneuria sp. b	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Perlesta placida	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pteronarcys (nobilis)	2	--	--	--	1	--	--	--	--	--	1	--	--	--	1	--	--	--	--	--
Togoperla sp. a (Rossi)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ephemeroptera																				
Baetis cingulatus	32	13	2	28	28	15	82	21	--	19	54	11	26	52	87	30	69	37	30	10
Baetis sp.	30	7	--	8	--	4	64	16	12	10	152	6	44	62	120	60	201	68	54	29
Ephemera sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ephemerella euterpe (?)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ephemerella infrequens	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ephemerella needhami	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ephemerella needhami gp sp.?	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ephoron sp.	--	--	--	2	--	--	--	--	--	1	--	--	--	--	--	--	--	--	--	--
Habrophlebiodes sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Heptagenia sp.	20	2	11	26	3	--	86	1	17	29	--	--	--	4	6	--	42	--	4	1
Isonychia albomanicata	--	--	--	--	--	--	--	--	--	--	2	--	--	--	--	--	--	--	--	--
Pseudocloeon carolina	12	--	7	10	--	2	2	--	--	3	--	1	28	10	3	--	3	--	--	2
Pseudocloeon cingulatum	8	3	3	--	--	--	10	--	--	--	--	1	--	18	3	62	--	--	--	--
Pseudocloeon punctiventris	8	1	--	--	--	236	20	--	--	--	34	6	--	14	3	352	54	83	4	--
Stenonema sp. 1	8	3	6	20	22	--	26	8	24	28	--	1	10	6	3	--	--	--	10	5
Stenonema sp. 2	--	--	--	--	--	--	2	--	2	--	--	--	2	4	9	--	33	--	56	24
Stenonema sp. 3	--	5	6	18	5	--	22	18	11	8	8	1	66	60	102	--	78	4	94	22
Tricorythodes sp.	--	--	--	--	--	2	2	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichoptera																				
Agapetus sp.	--	--	6	--	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Agraylea sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	2	--	--	--	--	--	--
Athripsoides sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3	--	--	--	--	--
Brachycentrus americanus	--	--	--	--	--	--	--	1	--	--	--	--	--	--	--	--	--	1	--	--
Brachycentrus lateralis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cheumatopsyche sp.	36	9	81	54	14	2	6	14	35	31	24	12	46	26	36	--	8	5	34	5
Chimarra socia	--	--	--	--	--	--	--	--	--	--	32	3	--	--	--	--	--	--	--	--
Helicopsyche sp.	--	1	--	--	--	--	--	--	--	--	--	--	2	--	--	--	--	--	--	--
Hydropsyche sp. 1	156	6	54	39	68	--	44	18	4	2	162	2	136	48	165	2	106	26	18	5
Hydropsyche sp. 2	177	31	51	6	84	--	60	43	2	1	66	8	21	--	24	--	58	16	--	--
Hydropsyche sp. 3	222	18	171	165	152	--	82	36	24	38	56	2	94	66	114	--	38	9	26	7
Leucotrichia sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2	1
Neophylax sp.	--	--	87	189	42	--	--	--	33	63	--	--	86	68	9	--	--	--	60	25
Neotrichia sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Oecetis cinerescens	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--
Protoptila sp.	--	--	3	6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Psychomyia flavida	3	--	12	27	2	--	2	--	3	5	--	--	14	20	3	--	2	--	10	5
Pycnopsyche sp.	--	--	--	--	4	--	--	--	--	--	--	--	--	--	36	--	--	--	2	--
Triaenodes sp.	--	--	--	--	--	3	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Turbellaria																				
Unidentified genus	--	1	--	9	--	1	--	1	2	1	--	--	--	12	4	--	--	--	14	--
Amphipoda																				
Gammarus sp.	5	--	3	15	58	14	5	2	12	11	--	--	2	4	12	8	2	3	14	--
Coleoptera																				
Dubiraphia sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ectopria sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	2	--	--	--	--	--	--
Macronychus glabratus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Microcylloepus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Optioservus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Promoresia sp.	1	--	2	7	1	--	--	--	2	--	--	--	10	--	4	--	--	--	--	--
Rhizelmis sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	10	--	--	1	--	--	--
Stenelmis sp.	1	2	20	17	7	--	1	--	6	--	2	2	30	--	30	--	--	--	--	4
Isopoda																				
Asellus sp.	1	1	--	--	4	--	--	1	--	7	6	--	--	38	--	--	1	--	16	--

APPENDIX I (Continued)

COMPLETE COMPILATION OF INDIVIDUAL TAXA AND NUMBERS ACCUMULATED THROUGHOUT SAMPLER COMPARISON STUDY

Station 2 (Continued). Tomorrow Riffle Habitat

	July										September									
Taxa	T 1 Balls	T 1 Plate	T 1 Sur-	T 1 Sur-	T 1 Wood Qual.	T 1 Net Qual.	T 2 Ball	T 2 Plate	Sur-	Sur-	T 1 Ball	T 1 Plate	T 1 Sur- ber	T 1 Sur- ber	T 1 Wood Qual.	T 1 Net Qual.	T 2 Ball	T 2 Plate	T 2 Sur- ber	T 2 Sur- ber
Decapoda																				
Orconectes illinoiensis	--	--	--	--	--	4	2	--	--	--	--	--	--	--	--	--	--	--	--	--
Orconectes sp. 2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	1	--	1
Unident. immature O	3	--	--	1	--	--	--	--	--	--	--	--	--	--	1	--	--	1	--	--
Diptera																				
Antocha sp.	1	--	26	61	5	--	--	1	14	13	2	--	102	160	20	--	22	--	74	26
Atherix sp.	--	--	--	2	1	--	--	--	--	--	--	--	2	--	--	--	--	--	--	--
Cardiocladius sp.	--	1	6	22	13	--	--	1	2	--	20	--	22	12	14	--	2	--	--	--
Cladotanytarsus sp.	--	--	--	4	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--
Coryoneura sp.	9	2	--	8	4	2	--	--	--	--	14	4	14	22	22	2	26	2	22	5
Cricotopus sp. 1	12	1	4	36	6	4	--	2	--	2	54	8	56	120	60	12	54	28	48	18
Cricotopus sp. 2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Diamesa sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Eukiefferiella sp. 1	138	15	40	2	72	6	20	18	1	1	72	2	12	2	28	--	18	13	--	--
Eukiefferiella sp. 2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hemerodromia sp.	--	--	2	--	1	--	--	--	--	--	4	--	2	--	4	--	--	--	--	--
Larsia sp.	--	--	--	--	--	--	--	--	2	--	--	--	--	--	--	--	--	--	--	--
Microtendipes sp.	--	--	4	8	2	--	--	--	--	--	--	--	2	--	--	--	--	--	--	--
Nilotanypus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Orthocladius sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5	--	--	--	--
Polypedilum fallax	174	11	88	114	70	4	40	36	20	12	441	1	42	42	36	1	26	21	30	7
Prosimulium sp.	36	15	6	2	37	8	9	22	--	--	--	22	2	6	44	86	128	82	--	--
Pseudodiamesa pertinax	--	--	2	6	2	--	--	--	--	--	--	--	2	2	--	--	--	1	--	--
Rheotanytarsus sp.	--	--	4	--	--	--	--	1	--	1	6	2	4	14	4	--	4	10	2	--
Tanytarsus sp.																				
Stratiomyiidae sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Stictochironomus sp.	--	--	2	2	--	--	--	--	--	--	--	--	2	--	--	--	--	--	2	--
Thienemaniella sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Gastropoda																				
Ferrissia sp.	--	--	--	--	--	--	--	--	--	--	--	--	2	--	2	--	2	--	--	--
Pelecypoda																				
Sphaerium sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Oligochaeta																				
Nais behingi	12	--	6	28	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nais bretscheri	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nais communis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nais sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Limnodrilus hoffmeisteri	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Rhyacodrilus coccineus	--	--	--	--	--	--	--	--	--	--	10	--	8	26	6	--	10	--	14	--
Unident. immature without Cappiliform chaetae	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Taxa	26	22	30	32	29	15	22	21	21	22	23	20	32	31	35	13	27	20	24	22
Total Individuals	1120	158	724	960	743	307	594	268	236	286	1234	345	906	934	1070	622	995	420	666	235
Total Taxa by Month	July 48 – 53%										September 52 – 58%									
Total Taxa by Sampler Type	Combined Plates 40		Qual. Net 23																	
% of Total	44		25																	
Sample as % Total Taxa	29	24	33	35	32	16	24	23	23	24	25	22	35	34	39	14	30	22	26	24

APPENDIX I (Continued)

COMPLETE COMPILATION OF INDIVIDUAL TAXA AND NUMBERS ACCUMULATED THROUGHOUT SAMPLER COMPARISON STUDY

Station 3. Wolf River Habitat

Taxa	May							June									
	Qual. Wood	Qual. Wood	Qual. Rock	Qual. Pete. U.S.	Qual. Pete.	Qual. Pete.	Net in Veg.	U.S. Balls	U.S. Plate	D.S. Balls	D.S. Plate	Qual. Wood	Qual. Rock	2 Quant. Pete. U.S.	2 Quant. Pete. D.S.	Qual. Net Trees	Qual. Net Grass
Plecoptera																	
Isoperla bilineata	9	39	--	1	--	--	30	--	--	--	--	--	--	--	--	--	--
Perlesta placida	--	--	--	--	--	--	--	42	37	36	8	107	--	--	--	11	1
Pteronarcys (nobilis)	--	--	--	--	--	--	--	6	--	--	--	--	--	--	--	--	--
Ephemeroptera																	
Baetis sp.	--	--	--	--	--	--	--	12	--	4	2	1	1	--	--	3	--
Baetisca lacustris	--	--	--	--	--	--	1	--	--	--	--	--	--	--	--	--	--
Brachycercus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--	--
Caenis sp.	--	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--
Ephemerella needhami	2	11	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ephoron sp.	--	--	--	--	--	--	--	--	--	--	--	--	1	--	3	--	--
Heptagenia sp.	51	25	--	--	--	--	--	--	23	32	20	26	--	--	--	--	--
Isonychia albomanicata	--	--	--	--	--	--	--	18	2	46	--	--	--	--	--	--	--
Isonychia sadleri	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Leptophlebeidae unident. genus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Neocloeon sp.	--	--	--	--	--	--	--	--	--	--	--	5	--	--	--	--	711
Pseudocloeon sp.	18	8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Rhithrogena sp.	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--	--	3
Siphlonurus quebecensis	--	--	--	--	--	--	56	--	--	--	--	--	--	--	--	--	7
Stenonema sp.	--	25	--	--	--	--	--	46	12	50	23	37	2	--	--	--	--
Tricorythoides sp.	--	--	--	--	--	--	--	2	--	8	1	--	--	--	--	--	--
Trichoptera																	
Agraylea sp. 1	22	13	--	--	--	--	--	--	4	--	--	--	--	--	--	--	1
Agraylea sp. 2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Athripsoides (tarsi-punctatus)	--	1	2	--	--	--	--	4	4	4	12	30	3	--	--	--	--
Brachycentrus americanus	--	--	--	--	--	--	--	28	8	32	20	106	--	--	--	--	--
Cheumatopsyche sp.	256	145	2	--	--	--	--	720	760	1608	832	1936	32	--	22	--	7
Chimarra socia	6	9	--	--	--	--	--	56	68	132	28	66	--	--	--	--	--
Hydropsyche orris	54	28	--	--	--	--	--	--	8	4	8	94	--	--	--	--	--
Hydropsyche sp. 1	124	83	--	--	--	--	--	24	36	52	76	312	1	--	--	--	--
Hydropsyche sp. 2	6	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ithytrichia sp.	--	1	--	--	--	--	--	8	4	--	--	--	--	--	--	--	--
Mayatrichia sp.	--	--	--	--	--	--	--	--	--	4	--	--	--	--	--	--	--
Mollana (pupa) sp.	--	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--
Neophylax sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Neureclipsis sp.	--	1	--	--	--	--	--	12	20	12	--	6	16	--	--	--	--
Oecetis cinerascens	6	--	--	--	--	--	--	8	4	8	--	--	1	--	--	--	--
Psychomyia flavida	8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pycnopsyche sp.	--	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--
Polycentropus (c.f. remotus)	--	--	13	--	--	--	--	12	4	16	12	6	9	--	--	--	--
Triaenodes sp.	--	--	--	--	--	--	--	--	1	--	--	--	--	--	--	--	--
Coleoptera																	
Ancyronyx sp.	--	2	--	--	--	--	--	--	--	--	1	4	--	--	--	--	--
Cleptelmis sp.	1	1	1	--	--	--	--	2	1	2	--	4	--	--	--	--	--
Coptotomus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3
Dytiscus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Dineutus sp.	--	--	--	--	--	--	--	8	3	14	5	15	1	--	--	--	--
Dubiraphia sp.	--	--	--	--	--	--	--	6	--	6	--	--	--	1	2	--	--
Gyretes sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3
Heterelmis sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hydrocanthus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--
Hydroporinae Unident. genus	--	--	--	--	--	--	--	--	--	2	--	--	1	--	--	--	--
Machronychus glabratus	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Promoresia sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Stenelmis sp.	5	24	--	--	--	3	--	72	9	100	6	34	2	--	1	1	--
Turbellaria																	
Unident. genus	--	--	--	--	--	1	--	8	--	18	--	34	2	--	1	--	--

APPENDIX I (Continued)

COMPLETE COMPILATION OF INDIVIDUAL TAXA AND NUMBERS ACCUMULATED THROUGHOUT SAMPLER COMPARISON STUDY

Station 3 (Continued): Wolf River Habitat

Taxa	May							June									
	Qual. Wood	Qual. Wood	Qual. Rock	Qual. Pete. U.S.	Qual. Pete. D.S.	Qual. Pete. D.S.	Net in veg.	U.S. Balls	U.S. Plate	D.S. Balls	D.S. Plate	Qual. Wood	Qual. Rock	2 Quant. Pete. U.S.	2 Quant. Pete. D.S.	Qual. Net Trees	Qual. Net Grass
Isopoda																	
Asellus sp.	--	5	5	1	--	--	--	102	4	98	1	--	--	3	1	--	--
Amphipoda																	
Gammarus sp.	--	--	--	--	--	--	--	76	6	130	--	9	7	--	1	1	--
Hyallela azteca	2	--	1	--	--	--	9	--	--	--	--	--	--	--	--	--	6
Hydracarina																	
Unident. genus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4	--
Odonata																	
Hetaerina sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Unident. Zygoptera	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hemiptera																	
Cynatia americanus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	18	--
Hydrometra martini	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--
Lethocerus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Limnogonus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--
Plea striola	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	14	--
Neuroptera																	
Climacia sp.	--	--	--	--	--	--	--	--	--	--	--	--	2	--	--	--	--
Diptera																	
Ablabesmyia sp.	--	--	2	--	--	--	--	12	--	12	--	--	10	--	--	--	--
Bezzia sp.	--	--	2	--	9	26	--	3	--	--	--	2	--	8	2	53	--
Chironomus sp.	--	--	3	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Conchapelopia sp.	8	4	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Coryoneura sp.	4	3	--	--	--	--	--	--	--	--	2	--	--	--	--	--	--
Cladotanytarsus sp.	--	5	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cricotopus 2 spp.	1296	47	19	--	--	--	--	--	--	--	--	2	--	--	--	--	--
Cryptochironomus sp.	--	--	13	1	--	--	--	30	3	12	6	9	2	--	2	7	1
Dicrotendipes modestus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dicrotendipes sp.	--	--	3	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Endochironomus sp.	--	--	--	--	--	--	--	30	--	56	6	22	20	--	13	3	3
Eukiefferiella sp. 1	--	--	--	--	2	2	--	72	12	4	4	2	--	--	--	--	--
Eukiefferiella sp. 2	--	--	--	--	--	--	--	--	75	224	22	156	18	--	1	--	1
Hemerodromia sp.	5	--	--	--	--	--	--	3	--	4	2	2	--	--	--	--	--
Larsia sp.	--	--	--	--	--	--	--	33	3	28	4	12	10	--	--	--	--
Nilotanypus sp.	--	1	12	--	--	--	--	9	--	32	8	14	6	--	--	--	--
Odontomyia sp.	--	--	--	--	--	--	--	2	--	--	--	--	--	--	--	--	--
Parachironomus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Polypedilum fallax	--	1	--	--	12	10	--	--	--	--	--	--	--	--	--	--	--
Polypedilum sp.	38	--	--	1	--	--	2	15	117	180	62	258	22	--	5	62	9
Potthastia longimanus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Procladius sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	4	--	--	--
Prosimulium sp.	20	4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Psectrocladius sp.	--	--	23	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Stenochironomus sp.	--	--	--	--	--	--	--	--	--	--	--	2	--	--	--	--	--
Tanytarsus sp.	12	--	--	--	--	--	--	84	57	212	88	180	54	4	21	1	3
Rheotanytarsus sp.																	
Thienemaniella sp.	--	--	--	--	--	--	1	--	--	--	--	--	--	--	--	--	--
Gastropoda																	
Ammnicolidae sp.	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ferrissia sp.	--	--	--	--	--	--	--	--	--	--	--	--	6	--	--	--	--
Physa sp.	--	--	--	--	--	--	--	--	--	--	--	--	2	--	--	--	--
Pleurocera sp.	--	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--
Somatogyrus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pelecypoda																	
Bulimus sp.	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	3	--
Eliptio (?) sp.	--	--	1	--	--	2	--	--	--	--	--	--	--	--	--	--	--
Lampsilis sp.	--	--	--	--	--	--	--	--	--	--	--	--	3	1	1	--	--
Physella sp.	--	--	--	--	--	--	1	--	--	--	--	--	--	--	--	--	--
Oligochaeta																	
Aulodrilus americanus	--	--	--	--	--	--	1	--	--	--	--	--	--	--	--	--	--
Arcteonais lomondi	--	--	--	--	--	--	--	--	--	--	--	--	--	2	--	--	--
Limnodrilus claparedianus	--	--	--	5	12	--	--	--	--	--	--	--	--	--	--	--	--
Limnodrilus hoffmeisteri	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Limnodrilus udekemianus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	20	--	--
Nais communis	28	6	1	--	--	--	--	6	9	40	--	--	8	--	1	--	--
Nais behingi	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nais bretscheri	--	--	67	7	--	--	--	--	--	--	--	--	--	--	--	--	--
Nais simplex	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nais sp.	--	--	--	--	--	--	--	9	--	20	--	26	--	--	--	--	--
Rhyacodrilus coccineus	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Slavina appendiculata	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--
Stylaria lacustris	--	--	--	--	--	--	--	3	--	--	--	--	--	--	--	--	--
Unident. immature without Capilliform chaetae	--	2	28	3	--	--	--	--	--	--	--	--	40	96	152	--	--
Hirudinea																	
Erpobdella sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Helobdella fusca	--	--	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--
Total Taxa	24	27	22	6	4	8	8	36	28	36	27	33	32	8	18	17	15
Total Individuals	1982	497	203	14	26	156	101	1583	1294	3242	1260	3520	286	119	250	185	760
Total Taxa by Month	May 55 — 46%							June 74 — 62%									
Total Taxa by Sampler Type	Qual. Wood		Qual. Rock		Pete.		Veg. Net Qual.	Balls		Plates		Qual. Net Trees					
	51		55		35		20	52		45		17					
% of Total	42		46		29		16	43		37		14					
Sample as % Total Taxa	20	22	18	6	3	6	6	30	23	30	22	27	26	6	15	14	12

APPENDIX I (Continued)

COMPLETE COMPILATION OF INDIVIDUAL TAXA AND NUMBERS ACCUMULATED THROUGHOUT SAMPLER COMPARISON STUDY

Station 3 (Continued). Wolf River Habitat

Taxa	July								September									
	U.S. Balls	U.S. Plate	D.S. Balls	D.S. Plate	Qual. Wood	Qual. Rock	Quant. Pete. U.S.	Quant. Pete. D.S.	U.S. Balls	U.S. Plate	D.S. Balls	D.S. Plate	Qual. Wood	Qual. Wood	Qual. Rock	Qual. Rock	Quant. Pete. U.S.	Quant Pete. D.S.
Plecoptera																		
Isoperla bilineata	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Perlesta placida	--	--	--	3	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pteronarcys (nobilis)	--	--	--	--	--	--	--	--	--	2	--	1	1	7	--	--	--	--
Ephemeroptera																		
Baetis sp.	26	44	70	111	220	68	2	--	54	68	138	124	284	248	88	84	--	--
Baetis lacustris	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Brachycercus sp.	--	--	--	--	--	--	--	1	--	--	--	--	--	--	--	--	--	--
Caenis sp.	--	--	2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ephemerella needhami	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ephoron sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Heptagenia sp.	4	6	4	3	76	--	--	--	15	6	34	4	24	12	2	6	--	--
Isonychia albomanicata	4	4	--	3	--	4	--	--	2	4	--	6	24	20	--	--	--	--
Isonychia sadleri	--	2	--	15	--	--	--	--	--	--	--	2	--	20	--	--	--	--
Leptophlebeidae unident. genus	--	--	--	--	--	--	--	--	3	--	--	--	--	--	--	4	--	--
Neocloeon sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pseudocloeon sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Rhithrogena sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Siphlonurus quebecensis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Stenonema sp.	84	70	26	63	84	50	1	--	87	52	99	104	124	140	24	44	--	--
Tricorythoides sp.	2	2	34	12	--	50	--	--	3	--	12	--	4	--	12	12	--	--
Trichoptera																		
Agraylea sp. 1	6	--	24	20	48	364	--	1	--	--	36	24	72	12	222	120	--	--
Agraylea sp. 2	--	--	18	--	--	12	--	--	--	--	--	--	--	--	--	12	--	--
Athripsoides (tarsi-punctatus)	--	--	--	--	--	8	--	--	--	--	--	--	--	12	--	--	--	--
Brachycentrus americanus	48	6	6	8	24	--	--	--	36	6	36	12	72	--	--	--	--	--
Cheumatopsyche sp.	1716	846	1218	864	1048	336	10	2	2136	1470	2940	2004	4932	2675	1392	1506	2	4
Chimarra socia	372	96	258	248	24	64	--	--	1134	330	2604	1152	--	1116	168	180	--	1
Hydropsyche orris	18	6	--	4	56	--	1	--	18	--	--	24	240	168	42	6	--	--
Hydropsyche sp. 1	180	96	54	--	--	24	3	--	132	132	492	300	804	62	78	72	--	--
Hydropsyche sp. 2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ithytrichia sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mayatrichia sp.	--	--	2	--	--	8	--	--	--	--	--	--	--	--	--	--	--	--
Mollana (pupa) sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Neophylax sp.	--	--	--	--	--	12	--	--	--	--	--	--	--	--	4	3	--	--
Neureclipsis sp.	78	27	48	32	16	88	--	--	48	--	12	12	12	--	36	66	--	--
Oecetis cinerascens	--	--	18	--	--	8	--	--	24	--	--	6	--	--	6	6	--	--
Psychomyia flavida	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pycnopsyche sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Polycentropus (c.f. remotus)	--	--	--	--	--	8	--	--	--	--	--	--	--	--	--	--	--	--
Triaenodes sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Coleoptera																		
Ancyronyx sp.	--	--	--	--	--	--	--	--	--	--	9	2	2	3	--	--	--	--
Cleptelmis sp.	--	1	--	--	4	--	--	--	4	--	--	14	--	12	--	--	--	--
Coptotomus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dytiscus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dineutus sp.	8	2	2	6	4	4	--	--	--	--	--	--	--	--	--	--	--	--
Dubiraphia sp.	--	--	4	--	--	--	--	6	--	--	12	--	--	--	--	--	--	--
Gyretes sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Heterelmis sp.	--	--	--	--	2	--	--	--	--	--	--	--	--	3	--	--	--	--
Hydrocanthus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hydroporinae Unident. genus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Machronychus glabratus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Promoresia sp.	--	--	--	--	--	--	--	--	4	--	3	--	--	--	--	--	--	--
Stenelmis sp.	2	5	10	12	36	44	--	--	12	4	63	10	6	78	8	4	--	1
Turbellaria																		
Unident. genus	106	15	208	3	44	110	1	--	82	12	276	54	132	185	208	216	--	1

APPENDIX I (Continued)

COMPLETE COMPILATION OF INDIVIDUAL TAXA AND NUMBERS ACCUMULATED THROUGHOUT SAMPLER COMPARISON STUDY

Station 3 (Continued). Wolf River Habitat

Taxa	July								September									
	U.S. Balls	U.S. Plate	D.S. Balls	D.S. Plate	Qual. Wood	Qual. Rock	Quant. Pete. U.S.	Quant. Pete. D.S.	U.S. Balls	U.S. Plate	D.S. Balls	D.S. Plate	Qual. Wood	Qual. Wood	Qual. Rock	Qual. Rock	Quant. Petc. U.S.	Quant Pete. D.S.
Isopoda																		
Asellus sp.	2	--	4	--	--	--	--	--	--	--	--	--	--	--	2	--	--	--
Amphipoda																		
Gammarus sp.	2	--	--	--	2	24	--	--	2	--	--	--	--	--	--	12	--	--
Hyallela azteca	--	--	6	3	--	--	--	--	--	--	3	2	--	--	4	--	--	--
Hydracarina																		
Unident. genus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Odonata																		
Hetaerina sp.	--	--	--	3	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Unident. Zygoptera	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2	2	--	--
Hemiptera																		
Cynatia americanus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hydrometra martini	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lethocerus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--
Limnogonus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Plea striola	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Neuroptera																		
Climacia sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Diptera																		
Ablabesmyia sp.	--	--	--	--	4	18	--	--	--	--	2	--	--	--	--	3	--	--
Bezzia sp.	--	--	--	--	--	2	5	--	--	--	--	--	--	--	--	--	3	1
Chironomus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Conchapelopia sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Coryoneura sp.	--	--	12	--	--	--	--	--	--	--	4	--	--	--	2	--	--	--
Cladotanytarsus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cricotopus 2 spp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cryptochironomus sp.	16	12	18	8	--	26	1	26	--	--	12	--	12	9	4	--	--	5
Dicrotendipes modestus	--	--	--	--	--	26	--	--	--	--	--	--	--	--	--	--	--	--
Dicrotendipes sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Endochironomus sp.	--	--	--	--	14	--	--	--	--	--	4	--	12	9	8	1	--	--
Eukiefferiella sp. 1	--	--	--	--	--	--	--	--	--	--	8	2	--	3	--	--	--	--
Eukiefferiella sp. 2	460	303	510	564	48	76	--	--	186	62	304	134	87	99	12	17	--	--
Hemerodromia sp.	4	--	4	4	2	8	--	--	4	12	48	18	8	9	2	--	--	--
Larsia sp.	4	6	12	4	4	16	--	--	--	2	--	2	--	6	--	1	--	--
Nilotanypus sp.	8	--	30	24	6	22	--	--	3	--	--	--	--	--	--	2	--	--
Odontomyia sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Parachironomus sp.	--	--	--	--	--	26	--	--	--	--	--	--	--	--	--	--	--	--
Polypedilum fallax	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Polypedilum sp.	52	27	96	52	16	12	--	--	--	--	--	2	9	9	2	3	--	--
Potthastia longimanus	--	--	--	--	--	--	--	--	--	--	2	--	--	--	4	--	--	--
Procladius sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Prosimulium sp.	24	--	4	4	--	--	--	--	18	--	--	--	3	--	--	--	--	--
Psectrocladius sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Stenochironomus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tanytarsus sp.	88	75	162	40	28	54	--	--	42	18	60	50	69	24	46	11	--	--
Rheotanytarsus sp.																		
Thienemaniella sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Gastropoda																		
Ammnicolidae sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ferrissia sp.	--	1	--	3	--	20	--	--	2	--	6	--	--	--	--	28	--	--
Physa sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pleurocera sp.	--	--	--	--	--	4	--	--	--	--	--	--	--	--	--	2	--	--
Somatogyrus sp.	--	--	--	--	--	2	--	--	--	--	--	--	--	--	--	--	--	--
Pelecypoda																		
Bulimus sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Eliptio (?) sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lampsilis sp.	--	--	--	--	--	2	--	--	--	--	--	--	--	--	--	4	--	1
Physella sp.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Oligochaeta																		
Aulodrilus americanus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Arcteonais lomondi	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Limnodrilus claparedianus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Limnodrilus hoffmeisteri	--	--	--	--	--	--	2	41	--	--	12	--	--	6	--	--	4	47
Limnodrilus udekemianus	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nais communis	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nais behingi	--	--	--	--	--	--	--	--	--	--	--	--	--	3	6	--	--	--
Nais bretscheri	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nais simplex	--	--	--	--	--	--	--	--	--	--	--	2	--	--	--	--	--	--
Nais sp.	--	9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Rhyacordrilus coccineus	--	--	--	--	--	--	--	2	--	--	--	--	--	--	--	--	--	--
Slavina appendiculata	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Stylaria lacustris	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Unident. immature without Capilliform chaetae	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hirudinea																		
Erpobdella sp.	--	--	--	--	--	2	--	--	--	--	--	--	--	--	--	--	--	--
Helobdella fusca	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Taxa	25	23	29	27	23	35	9	7	24	15	27	26	22	28	26	28	3	8
Total Individuals	3314	1661	2859	2116	1810	1602	26	79	4051	2170	7231	4067	6933	4873	2385	2427	9	56
Total Taxa by Month	July 54 — 45%								September 51 — 42%									
Sample as % Total Taxa	21	19	24	22	19	29	7	5	20	12	22	21	18	23	21	23	2	6

APPENDIX II

CALCULATED NUMERICAL DIVERSITY INDEX FOR WOLF AND TOMORROW RIVER STATIONS

	Wolf		Tomorrow Riffle		Tomorrow Pool	
	D	R	D	R	D	R
Surber	--	--	4.45	0.231	4.50	0.120
Qual. wood	2.3	0.564	4.29	0.207	3.61	0.290
Qual. rock	3.5	0.335	--	--	--	--
Ekman	--	--	--	--	1.91	0.560
Pete.	3.0	0.101	--	--	--	--
Balls	2.8	0.498	3.96	0.279	4.15	0.246
Plate	2.4	0.538	3.93	0.257	3.86	0.232
Combined	2.9	0.550	4.50	0.253	4.69	0.240